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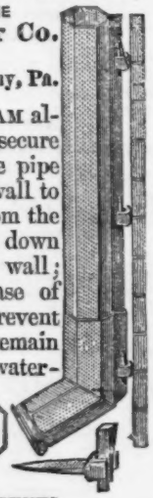

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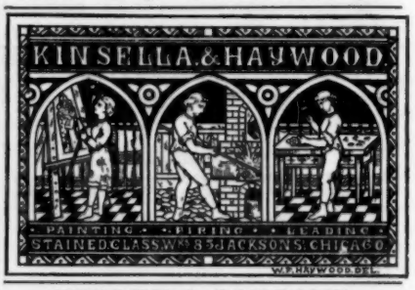

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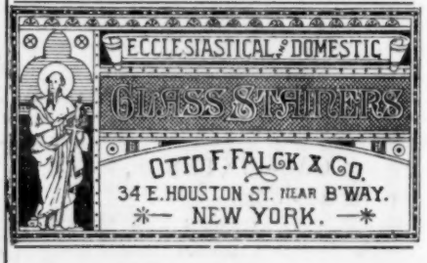

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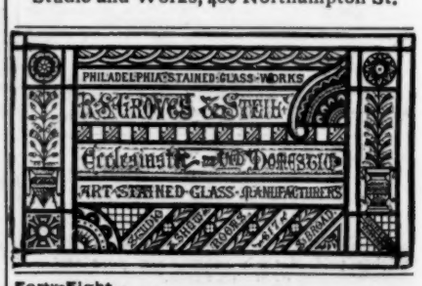

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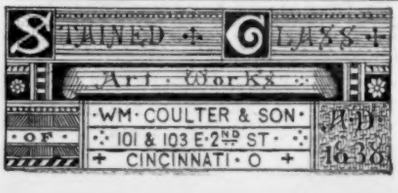

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Manufacturer of Hubbard's Patent
Inlaid Floors and Border.
The most beautiful and durable floor made. Hundreds of them in the finest houses in the country. Illustrated Catalogue sent free. Fine dwelling, office, and hotel interiors and Art Furniture from special designs. Drawings and estimates furnished on application.
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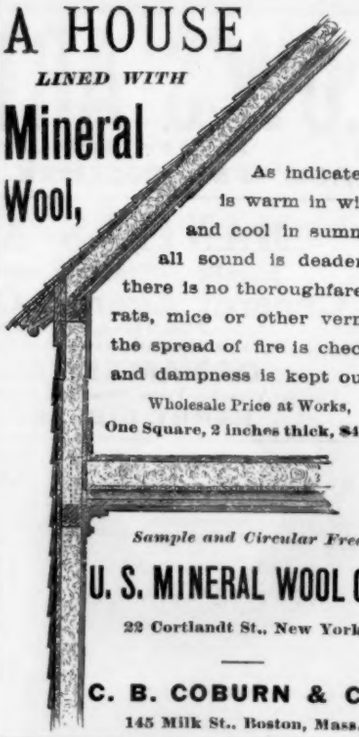
A HOUSE
LINED WITH
Mineral Wool,



As indicated, is warm in winter and cool in summer; all sound is deadened; there is no thoroughfare for rats, mice or other vermin; the spread of fire is checked and dampness is kept out.
Wholesale Price at Works,
One Square, 2 inches thick, $4.00.
Sample and Circular Free.
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C. B. COBURN & CO.,
145 Milk St., Boston, Mass.

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Manufacturers of Decorative Articles in Metal.
Friezes, Panels, Mantel-Facings, Bas-Reliefs, &c., from Original Designs or those furnished, for the interior Decoration of Dwelling-Houses, Public Buildings, Hotels, Elevator-Cabs, Parlor and Passenger Cars, Steamers, &c., in Copper, Brass, Bronze, and Silver, reproducing with exact fidelity natural objects or other models.
Special attention is called to the reproductions from natural leaves and flowers in the panels and tiles for furniture and interiors.
☞ Correspondence solicited and estimates furnished on application.
42 Batterymarch Street, Boston.
E. V. R. THAYER, President. S. L. HOLDREGE, Treasurer.

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Blue-Print Papers, Drawing Papers, Mathematical Instruments, Drawing Inks, Architectural and Fresco Designs.
Artists Materials Generally.
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Cash Capital	$3,000,000.00
Reserve for Re-Insurance	2,156,781.63
Reserve for Unadjusted Losses and other Liabilities	473,492.82
Surplus over all Liabilities	3,250,778.61

WATER COLORS
G. Wagner's Celebrated Specialty, for Architects and Designers. Send for Price-List to
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Z. WILE,
PASSENGER AND FREIGHT ELEVATORS,
Hand-Hoists, etc., of the latest improved inventions now manufactured. Invalid Elevators a specialty.
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Hydraulic Passenger and Freight Elevators, Hydraulic Dumb-Waiters, Freight & Hand Elevators.
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MACHINE AND ELEVATOR WORKS,
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Manufacturers and Dealers in all kinds of
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Hand-Hoists operated with ropes or cranks. Automatic Hatch-doors. Governors, and Safety-catches.
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Machinery Exclusively.
STEAM, HYDRAULIC
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HAND POWER
ELEVATORS.
Send for Catalogue and Prices.
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Manufacturer and Builder of the latest improved
Steam, Belt, and Hand-Power
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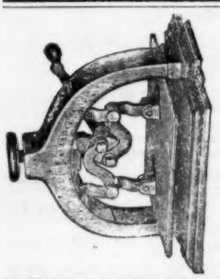
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To Architects and Builders. Save one-half the usual cost of Accident Insurance by insuring in the **United States Mutual Accident Association,** 320 and 322 Broadway, New York. The oldest, largest, strongest and surest Mutual Accident Association in the World. Insures against accidents at half the rates of stock companies. Architects or Draughtsmen, having office duties only, can receive $10,000 insurance with $50 weekly indemnity at a cost of about $25 per annum, or half that amount of insurance at corresponding rates. Architects or Master Builders, supervising only, may receive $4,000 insurance with $20 weekly indemnity. Annual cost, $12.
How to become a member: — Write for Circular and Application-Blank, and when received fill out your application, enclose $5 and forward it to the Secretary at New York, on receipt of which a policy will be promptly mailed to you.

WIRE LATHING,
ESPECIALLY ADAPTED TO
Public Buildings, Private Residences, Mills, Warehouses, Stores, and all Mercantile Structures.
IT IS POSITIVELY FIRE-PROOF.
WIRE LATHING possesses the following qualities:
IT IS NOT COSTLY.
IT IS EASILY AND CHEAPLY APPLIED.
PLASTERING ON THE WIRE LATH WILL NOT CRACK.
THE LATH WILL NOT CORRODE.
The plastering, when applied, **clinches** on both sides of the wire, **forming a double surface.**
THE WIRE LATHING is extensively used by the United States Government in its Custom House Court House, and Post Office Buildings.
It is indorsed by the leading Insurance Companies, who have applied it to their own fine edifices.
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White Lead and Linseed Oil.
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Unequalled Stock of Choice Hardware. Specifications figured and orders filled in all markets.

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OF VARIOUS TYPES AND PATTERNS.
SPECIAL PATTERNS
For Railway Water Stations, House Tank Service, Hydraulic Elevators, etc.
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CINCINNATI, CHICAGO,
ST. LOUIS, SAN FRANCISCO

HANOVER FIRE INSURANCE CO.

Cash Capital	$1,000,000.00
Reserve for Re-insurance	635,741.16
Reserve for all other Liabilities,	96,655.57
Net Surplus	832,744.56
Total Assets, January 1, 1883	2,565,141.29

BUILDING MATERIALS.
Reported for the American Architect and Building News.

BRICK.—₱ M.	New York. (Wholesale Prices.)	Boston.	Chicago. (Prices to Builders and Contractors.)	Philadelphia.
Common: *Cargo afloat.*				
Pale	$2 50 @ $3 50	Eastern 7 50 @ 8 00	Building Brick 6 50 @ 7 50	Hard 8 00 @ 8 50
Jersey	4 50 @ 5 25	Bay State Hard 9 00		Salmon 5 00 @ 6 00
Up River	5 00 @ 5 75	Domestic Com. 8 00 @ 9 00	Indiana Pressd 16 00 @ 28 00	Stretchers 11 00 @ 14 00
Haverstraw Bay	5 75 @ 6 25	Domestic Face 19 00 @ 20 00	St. Louis Fronts 25 00 @ 30 00	Pressed 20 00 @ 24 00
" 1st	6 25 @ 6 50			
Fronts:				
Croton, Brown	13 @ 14 00	Philadelphia 40 00 @ 45 00		
" dark	14 @ 15 00			
" red	14 @ 15 00	Phila. mould 50 00 @ 80 00		
Chicago pressed			22 00 @ 35 00	
Chicago Moulded			65 00 @ 350 00	
Baltimore	37 @ 41 00		50 00 @	
Glens Falls — white	30 @ 35 00	Glens Falls 25 00 @ 26 00		
Philadelphia	@ 27 00		42 00 @	
Trenton	@ 27 00		40 00 @	
Milwaukee		Glens Falls Mould. 30 00 @ 35 00	25 00 @	
Moulded:			60 00 @ 100 00	
Clark's Glens Falls — Red	25 00 @ 27 00		30 @	
" — White	30 00 @ 35 00	35 00 @ 40 00	35 @	
White " Mold,	45 00 @ 60 00	45 00 @ 60 00	55 00 @ 65 00	
Enamelled: *Imp.*				
Enamelled (edge.)	85 00 @ 100 00	@	@ 100 00	Dom. @ 70
Enamelled (edge and end)	90 00 @ 115 00	@	@ 125 00	@ 85
CEMENT, LIME, etc.—(₱ *cask.*)				
Chicago Lime in bulk			65 @ 75	
Wisconsin "			80 @ 90	
Rosendale Cement	80 @ 1 00	@ 1 50	*Not Sold.*	1 25 @ 1 65
Utica, Akron, Buffalo, Louisville, Milwaukee	*Not sold.*	*Not sold.*	1 00 @ 1 25	*Not sold.*
Portland (English)	2 60 @ 3 10	@ 3 20	2 75 @ 3 00	2 20 @ 3 50
" (Saylor's Am.)	2 05 @ 2 40	2 50 @ 3 00	2 75 @ 3 00	2 50 @ 3 00
" (Dyckerhoff)	2 75 @ 3 15	3 00 @ 3 50	3 25 @ 3 75	3 00 @ 3 25
" (Lafarge)	3 50 @ 3 75	*Not sold.*	3,75 @ 4 25	4 50 @
" (Star)	2 70 @ 3 00	*Not sold.*	*Not sold.*	*Not sold.*
K. B. & S. (Eng.) Portland	2 85 @ 3 10		3 35 @ 3 50	3 00 @ 3 25
Burham " "	2 60 @ 2 80		3 15 @ 3 35	2 75 @ 3 00
Vorwohler	2 65 @ 3 25		3 00 @ 3 25	
German (Fewer)	2 50 @ 2 70	3 15 @ 3 35	3 15 @ 3 35	
" (Alsen)	2 50 @ 2 80	3 00 @ 3 50	3 15 @ 3 35	2 90 @ 3 25
Selenitic		1 65	*Not sold.*	
Hydraulic Lime of Teil	3 50 @ 4 00		*Not sold.*	
Roman	2 75 @ 3 00	@ 3 20	2 75 @ 3 25	3 25 @ 3 50
Keene's coarse	5 00 @ 6 00	@ 7 50	7 50 @ 9 00	6 50 @ 7 00
" fine	9 25 @ 10 25	@ 11 50	11 00 @ 12 50	11 50 @ 12 00
Lime:				
Rockland and Rockport, (Com.)	@ 1 00	@ 1 10	*Not sold.*	1 00 @ 1 25
Rockland and Rockport, finish	@ 1 20	@ 1 15	*Not sold.*	
State, com. cargo rates (nom.)	75 @ 80	*Not sold.*	*Not sold.*	*Not sold.*
State, finishing "	@ 1 00	*Not sold.*	*Not sold.*	*Not sold.*
Plaster of Paris (calcined.)	1 30 @ 1 35	1 70 @ 1 90	@ 1 75	1 60 @ 2 25
" (casting)	1 50 @ 1 65	@ 2 25	@ 2 00	2 25 @ 2 50
Hair (Cattle) ₱ *bush*	21 @ 23	@ 30	30 @ 35	22 @ 30
" (Goat)	30 @ 35	@ 30	35 @ 40	@
Sand, ₱ *load*	1 00 @ 1 25	@ 1 50	100 @ 1 25	75 @ 1 50
STONE. (₱ *cubic foot, rough.*)				
Granite: (*Maine*)		@ 60		
Limestone:				
Bedford	@ 1 00	95 @ 1 00	50 @	3 75 @
Joliet	@		35 @ 55	
Lemont	@		35 @ 60	
Serpentine			80 @ 90	

(*Continued on page vi.*

10

FOR A SASH OF 250 LBS.

"MORTON'S METAL"

(Registered Trade-mark, May 1st, 1883.)

Cable and Champion Sash-Chains

and Patented Attachments.

The most **RELIABLE** and **CHEAPEST** article in the market for suspending

Window-Sashes.

HAS GREAT TENSILE STRENGTH,

Can be easily applied to any window, and gives SATISFACTION wherever used. Samples sent to any ARCHITECT free on application. Now in use in all the leading cities throughout the United States.

MANUFACTURED ONLY BY

THOMAS MORTON,

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CHAMPION CHAIN.

BUILDING MATERIALS.

	New York. (Wholesale Prices.)	Boston. (Prices to Builders and Contractors.)	Chicago. (Prices to Builders and Contractors.)	Philadelphia (Prices to Builders and Contractors.)
Foundation:				
Dimension	@	5 00 ℔ ton	20 @ 28	30 @ 5 00
Block	@	4 60 ℔ perch	8 50 ℔ cord.	50 @ 6 00
Rubble	@	1 25 @ 1 50	8 50 @	
Bluestone: (℔ *sq. ft.*)				
Sidewalk	30 @ 5 00	40 @ 1 75	75 @ 1 00	70 @ 90
Planed	50 @ 6 00	75	50 @ 1 00	1 10 @ 1 25
Sandstone,				
Longmeadow		75 @ 85		
Brown (Connecticut)	1 00 @	1 25 @ 1 45	1 50 ℔ cub.ft.	
Amherst	1 00 @	90 @ 1 00	55 @ 65	
Berea	75 @ 1 00	80 @ 90	45 @ 55	70 @ 90
Berlin	75 @ 1 00	80 @ 90	55 @ 65	
Bay of Fundy	@ 1 00	*Not sold*	*Not sold.*	
Belleville	80 @ 1 25	1 25 @ 1 35	"	
New Brunswick	@ 1 00	90 @ 1 00	"	
Caen	@	@ 2 00	"	
Marble:				
Lee, Mass	@	1 75 @ 2 50	*Not sold.*	2 00 @ 2 50
Rutland, white	@	@ 3 00	3 50 @ 5 00	2 25 @ 2 50
Sutherland Falls	1 25 @ 1 75	@ 2 00	3 50 @ 5 00	1 50 @ 2 50
Glens Falls, black	@	2 00 @ 3 00	*Not sold.*	4 00 @ 4 50
Italian, blue-veined	@	50 @ 60	@ 4 40	—— @ ——
" Sienna	@	3 00 @ 3 50	*Not sold.*	3 25 @ 6 50
Tennessee, red	@	1 25 @ 2 50	@ 4 00	2 00 @ 3 00
" Knoxville	@	85 @ 90	@ 4 00	@ 1 50
Pennsylvania, blue	@		*Not sold.*	2 23 @ 2 50
Vermont, white	@	1 50 @ 2 00	3 50 @ 5 00	
Slate:				
Roofing, (℔ *square*)	@			
" green	7 00 @ 8 00	4 50 @ 7 00	6 25 @ 8 10	@ 7 00
" purple	7 00 @ 8 50	5 50 @ 6 50	@ 8 60	@ 7 00
" red	@ 15 00	13 00 @ 14 00	—— @ 16 00	5 00 @ 5 75
" black, Lehigh	—— @ ——	*Not sold.*	7 20 @ 7 60	5 00 @ 5 75
" " Chapmans	—— @ ——	*Not sold.*	7 30 @ 8 00	6 00 @ 6 25
Tiles, Am. ℔ M.	@		*Not sold.*	@ 15 00
LUMBER.—℔ M.				
(*Ordinary dimensions.*)				
Boards:				
Pine, 1st quality, clear	65 00 @ 75 00	50 00 @ 53 00	44 00 @ 49 00	
" 2d quality	55 00 @ 60 00	42 00 @ 44 00	40 00 @ 46 00	
" 3d quality	18 00 @ 22 00	35 00 @ 38 00	37 00 @ 44 00	
Spruce	@ 25 00	11 00 @ 12 50	*Not sold.*	
Hemlock	ea. 17 @ 18	12 00 @ 12 50	@ 10 00	11 50 @ 15 00
Yellow pine	20 @ 40	30 00 @ 33 00	@ 28 00	16 00 @ 18 50
Cypress	@	@ 35 00	@	@
Clapboards:				
Pine	@	33 00 @ 55 00	14 00 @ 22 00	—— @ ——
Spruce	@	23 00 @ 30 00	*Not sold.*	—— @ ——
Framing Timber:				
Pine			13 00 @ 15 50	25 00 @ 35 00
Spruce	14 00 @ 18 00	13 50 @ 14 50	*Not sold.*	18 50 @ 20 00
Hemlock	12 00 @ 15 00	@	13 00 ℔ 19 00	12 00 @ 13 00
Yellow pine	20 00 @ 30 00	21 00 @ 25 00		22 00 @ 24 00
Laths:				
Pine	@	2 00 @ 2 25	2 25 @	—— @ ——
Spruce	2 25 @	2 25 @ 2 50	*Not sold.*	2 40 @ 2 60
Shingles:				
Pine, shaved	5 00 @ 6 00	@	*Not sold.*	
Pine, sawed	4 00 @ 5 00	@ 4 50	2 25 @ 2 60	
Spruce, sawed	2 50 @ 2 75	@ 1 50	*Not sold.*	
Redwood	2 10 @	@ 3 00	5 50 @ 8 00	30" $10 @ 28
Cedar, split	@	@	*Not sold.*	24" 8 @ 21
Cedar, sawed	@	2 00 @ 3 50	@ 2 30	20" 5 50 @ 14
Cypress 7 x 24.	18 00 @ 20 00	5 50 @ 6 00	*Not sold.*	16 00 @ 20 00
Miscellaneous:				
Piles ℔ ft.	4½ @ 6	Piles 6c. ℔ ft.	*Not sold.*	
Fence pickets, Spruce	8 00 @ 10 00	10 00 @ 18 00	Pine, 8 @ 22	12 00 @ 14 00
Cedar posts, 9 ft. (sq. posts.)	@	25 @ 35	9 00 @ 21 00	70 @ 1 25
Chestnut "	@	25 @ 35	*Not sold.*	28 @ 36
Finishing Woods: ℔ M.				
(*First Quality, Kiln-dried.*)				
Ash	@ 55 00	38 00 @ 48 00	35 00 @ 40 00	
Cherry	80 00 @ 120 00	60 00 @ 90 00	75 00 @ 85 00	55 00 @ 65 00
Chestnut	@ 55 00	38 00 @ 50 00	45 00 @ 50 00	60 00 @ 80 00
Butternut	40 00 @ 60 00	60 00 @ 70 00	45 00 @ 60 00	55 00 @ 65 00
Mahogany, Baywood	@ 180 00	100 00 @ 150 00	150 00 @ 180 00	100 00 @
" St. Domingo	@ 350 00	180 00 @ 250 00	250 00 @ 300 00	
Maple	45 00 @ 50 00	45 00 @ 65 00	30 00 @ 35 00	30 00 @ 50 00
Oak, red	@ 70 00	@ 50 00	35 00 @ 40 00	35 00 @ 45 00
" white	@ 70 00	@ 55 00	35 00 @ 40 00	55 00 @ 65 00
" quartered	@ 90 00	65 00 @ 70 00	50 00 @ 55 00	70 00 @ 80 00
Sycamore quartered		@ 65 00		
Pine, clear	65 00 @ 70 00	30 00 @ 65 00	45 00 @ 50 00	65 00 @ 90 00
Redwood	70 00 @ 75 00	60 00 @ 70 00	60 00 @ 70 00	100 00 @
Rosewood ℔ lb	@ 6		@ 7	
Walnut, black	125 00 @ 150 00	85 00 @ 100 00	80 00 @ 120 00	160 00 @ 200 00
Whitewood	45 00 @ 50 00	38 00 @ 45 00	30 00 @ 35 00	20 00 @ 30 00
Yellow pine ℔ M	@ 45 00	40 00 @ 45 00	30 00 @ 35 00	30 00 @ 35 00
Gumwood, best red			30 00 @ 35 00	
PAINTS. (*In oil,* ℔ *lb.*)				
White lead, Am	6½ @ 6¾	5¾ @ 6¼	6¼ @ 6½	4 @ 6¼
" Zinc, "	5 @ 8½	8 @ 12	7 @ 11	4 @ 8
Red, Am.,	6 @ 6½	@ 12	*Not sold.*	
" Venetian	6 @ 10½	7 @ 12	1¾ @ 2½	4 ℔ 6¼
" Vermilion	55 @ 60	55 @ 60 dry	50 @ 75	Am. 12 @ 16
Red Indian, Eng	12 @ 20	14 @ 20	12 @ 20	12 @ 16
Yellow Ochre	6 @ 15	7 @ 12	3 @ 15	4 @ 9
" Chrome	12 @ 20	18 @ 25	12 @ 25	12 @ 25
Green (chrome)	8 @ 13	12 @ 20	8 @ 20	9 @ 14
Green, Paris,	16 @ 20	25 @ 40	16 @ 35	14 @ 29
Black, lamp,	8 @ 12	15 @ 25	8 @ 30	12 @ 18
Blue, ultramarine	12 @ 18	18 @ 30	10 @ 35	20 @ 35
Oil, linseed, (raw) (℔ *gal.*)	56 @ 57	54 @ 59	57 @ 69	54 @ 58
" " boiled (℔ *gal.*)	59 @ 60	57 @ 62	60 @ 62	57 @ 60
Turpentine (℔ *gal.*)	30 @ 32	36 @ 43	35 @ 38	38 @ 41
Varnish, coach (℔ *gal.*)		1 50 @ 6 00	1 25 @ 2 00	1 40 @ 4 00
Shellac (℔ *gal.*)		2 50 @ 3 00	3 25 @ 4 00	1 75 @ 3 00
Putty	2 @ 3	2 @ 4	02 @ 03	2 @ 2½
Whiting (*dry.*)	50 @ 90	1 @ 1½	1 @ 2	½ @ 7-10
Paris white, (Eng.,) (*dry.*)	30 @ 2 00	2 @ 3	2 @ 2½	1 30 @ 1 60
Litharge, Am	5½ @ 5½	6½ @ 7	6½ @ 10	6½ @ 7
Sienna, (burnt)	12 @ 17½	14 @ 20	4 @ 16	9 @ 14
Umber, "	11 @ 16½	14 @ 20	@ 10	9 @ 14

(*Continued on page* vii.)

FOR HEAVY SASH

USE

RAYMOND'S

Compressed Lead Sash Weights,

With Wrought and Malleable-Iron fastenings.

Twice the heft of iron. Occupying only half the space.

Prices no higher than the ordinary cast lead-weights.

Freight allowed to any part of the country.

Send for Circular.

J. N. RAYMOND,

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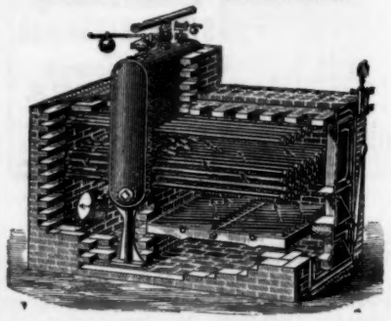
THE HOLLAND

Patent Wrought-Iron Boiler

FOR STEAM HEATING.



HOLLAND & THOMPSON, - - Troy, N. Y.

GOLD'S

Electric Warm Air Wrought-Iron Heaters.
Sectional Boilers.

Steam Compound-Coil Wrought-Iron Circulating Heaters.
Pin Radiators.

Combined Water and Steam Wrought-Iron Heaters, heated by live or Exhaust Steam for Cars, Factories, Shops, Conservatories, Public and Private Buildings, etc.

Saving in fuel fifty per cent over any other system.
Plans, specifications, & estimates furnished on application.

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14-16 Vandewater St., between Pearl and Frankfort Sts., New York.

PIPE-COVERING.

This covering is made entirely of Asbestos, and can not be affected injuriously by heat or dampness, nor can it be made a harbor for vermin.

Asbestos Building-Felt, Fire-Proof Cements, &c.

THE CHALMERS-SPENCE CO.,

419-421 E. 8th Street, - - NEW YORK.

PETER BACKUS,

Steam Heating Apparatus,

For Public or Private Buildings.

Sole New York Depot For the Sale of the

Albany Steam Trap Co.'s Specialties.

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(Bet. 6th & 7th Aves.)

Heating and Ventilation.

Fire ON THE Hearth

In various forms, viz: — **Air-Warming Grates, Fireplace Heaters, School-Room Heaters, Stoves, Double Heaters,** Each combining the ventilation of an open fire with the power and economy of a warm air furnace.

"Palace King Furnaces."

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The GOODWIN GAS STOVE & METER CO.,
MANUFACTURERS OF
The Sun Dial Gas Cooking and Heating Stoves.

The most economical in use. Over 50 different kinds. Suitable for Families, Hotels, Restaurants and Public Institutions. Laundry, Hatters' and Tailors' Heaters. Hot-Plates, Warming-Closets for Pantries. Hot-Water Generators, etc., etc.

1012-1016 Filbert Street, Philadelphia.

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126 Dearborn Street, Chicago.
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THE PERRET PATENT
FURNACES,

For burning Coal-dust, Sawdust, &c., will save from 50 to 90 per cent in your Fuel Account. Send for descriptive Circular.

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The New American Automatic
Steam Heater.
FOR DWELLINGS, PUBLIC BUILDINGS, RAILWAY STATIONS, OFFICES, &c.
Low Pressure, Self Regulating, Economical, Cheap, Durable.
UNIFORM HEAT. NO GAS. DUST, OR SMOKE. NO OBJECTIONS.
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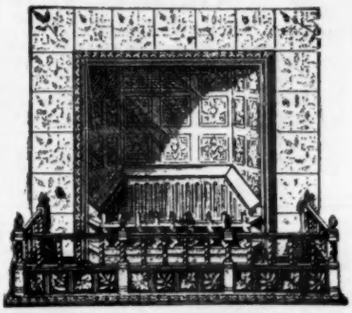
THOMAS S. DIXON & SONS,
MANUFACTURERS OF

FINE **GRATES**

Furnaces, Ranges.



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Gas-Log Fires.

IMPORTERS OF ENGLISH AND FRENCH FIRE-PLACE FITTINGS.
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Foundry, Westfield, Mass.

THE H. B. SMITH CO.,
MANUFACTURERS OF
The Union Steam and Water
HEATING APPARATUS,
For Public Buildings and Private Residences.
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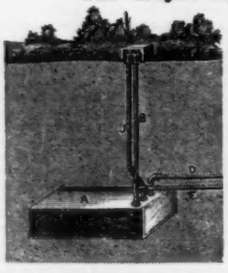

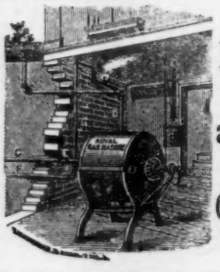

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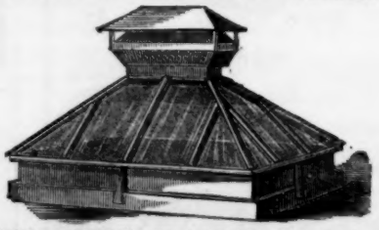

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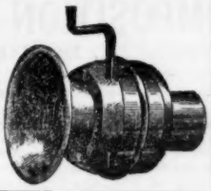

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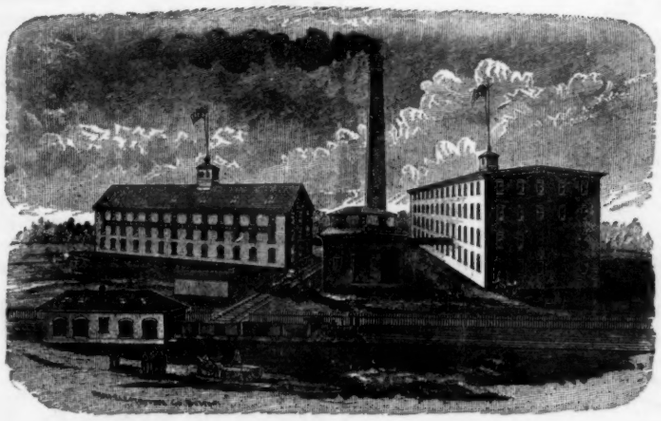

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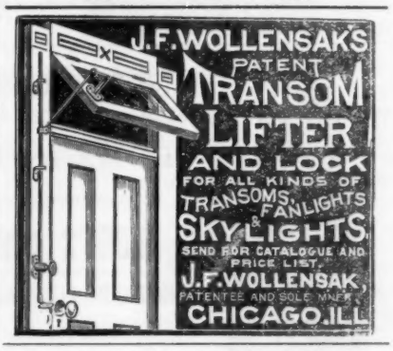

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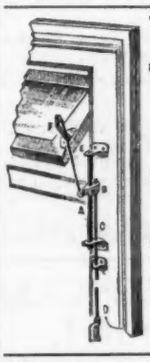

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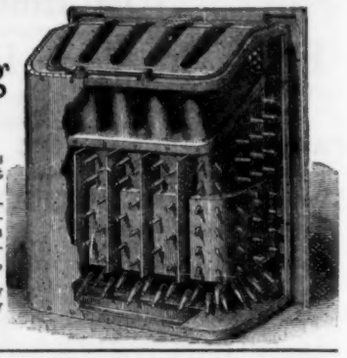

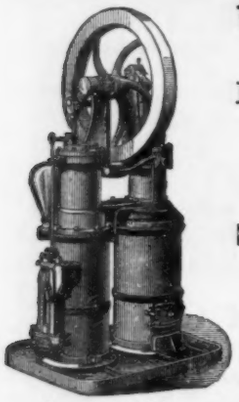

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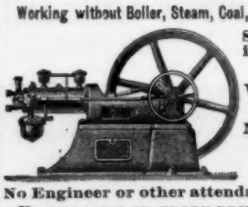

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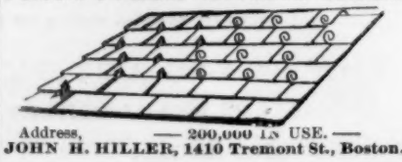

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A SINGULAR accident took place not long ago in Southern France, where a portion of an unfinished railroad bridge, all of iron, was blown bodily off the piers which supported it, and thrown into the ravine below. The bridge forms part of a new railway line in the Department of Creuse, and is an engineering structure of considerable interest and importance, the central span being two hundred and ninety-seven feet high above the water of the river which flows beneath it, and three hundred and twenty-five feet long in the clear between the supporting piers. The roadway is supported by two large lattice girders, with horizontal wind-bracing, and at the time of the accident one of the shore spans had been completed, and the next, which was the central span, was in process of construction by building out from the finished work, something more than half having been put together and overhanging the chasm. The winds in that mountainous region are very severe, storms having been known to blow railway-cars off the track; but the unfinished bridge having resisted one tempest without the slightest apparent movement, it was considered safe. On the night of the twenty-sixth of last January, however, a still stronger wind attacked it, and in the morning all the iron-work of the incomplete span, with the completed one next to it, was found piled up on the rocks below, at some distance to leeward of the piers. The wreck contained four hundred and fifty tons of iron, and various theories have been advanced to account for the lifting of this enormous load from its supports, by the force of wind alone, and the displacement to a horizontal distance of forty-four feet, which was necessary to clear it from the piers. According to *Le Génie Civil*, the most reasonable supposition is that the unfinished span, projecting one hundred and seventy-two feet from the pier, vibrated to some extent under the effect of the gusts of wind, and this vibration, if it once became regular, might easily have been increased by successive impulses, until it became strong enough to tear away the rivets by which the parts were held together. In addition to this, the upward force which, as *Le Génie Civil* says, is always exerted by very severe winds, may have lessened the friction of the mass on the pier, so that the combined effort was sufficient to throw it entirely over.

THE New York *Tribune* gives a brief account of the natural gas-wells now in operation in and about Pittsburgh, from which it appears that the new fuel is likely to cause important changes in many details of manufacturing in that city. The first gas-well in the Pittsburgh district was opened by accident. A party of oil-hunters, while boring a well at Murraysville, twelve miles southwest of the city, struck, at the depth of twelve hundred feet, a vein of gas, which escaped under such pressure that the work of boring could not be continued, and the well was abandoned. The gas from the deserted well, being, it is said, heavier than air, soon accumulated in the low parts of the surrounding country, forming a disagreeable miasma, and attention having been perhaps again called to the well by this circumstance, an attempt was made to burn the gas in an enclosed space, to form lampblack. The result of this was the speedy destruction of the buildings about the mouth of the well, and the enterprise was given up, but the gas was allowed to burn, to keep it from infecting the air. Meanwhile, gas had been obtained in smaller quantities from several smaller wells, and utilized for fuel, and a new company was formed to collect and sell the product of the first well. As the quantity was very large, it was decided to convey it in pipes to Pittsburgh, where the demand would be practically unlimited. As soon as the pipes had been laid for this purpose, the proprietors of other wells began to imitate the example of the first company, and a combination was formed for the purpose of keeping up the price of the gas. Although it formed a clean and excellent fuel, the price at which it was sold by the producers rendered it little, if at all, cheaper than coal; and some of the larger consumers in Pittsburgh bored wells of their own, and were successful in reaching gas-veins. The earlier apprehensions as to the limitations of the supply have been removed by further experience, and the people of Pittsburgh believe that, even if their wells should prove less constant than those of Fredonia, N. Y., which have furnished gas for lighting the town for fifty years, they will give a supply sufficient for their needs for twenty years at least; and in consequence of this opinion the furnaces in manufactories, and cooking and heating stoves in dwelling-houses, are being rapidly altered to use the new fuel.

A REPORT was recently made, at the request of the Corporation of the city of Philadelphia, upon the comparative merits of various systems of paving. The report was drawn up by General Q. A. Gillmore, assisted by Messrs. Green and North, two well-known engineers, and appears to have a great deal of interest for other communities besides Philadelphia. Besides giving a description of the principal varieties of pavement now in use, the three engineers make recommendations as to the best sorts to be used under various circumstances. In their opinion, the new wooden pavement laid on a foundation of Portland cement concrete, about which so much has been said of late, is not the most desirable, considering its cost. Most of our readers know something of the singular contract under which this pavement is now being extensively laid in Paris, the company agreeing to lay and keep it in repair for eighteen years, in consideration of the payment by the city of a certain annual instalment of the price during that time. As the Philadelphia report informs us, instead of the trifling expense for repairs which the descriptions of the new pavement seemed to indicate as one of its advantages, the company furnishing it expects to renew the whole every four or six years, according to the amount of travel over it. The sum of the annual instalments, at the end of the eighteen years, counting interest, will be very little less than seventeen dollars per square yard, for which the city of Paris will, it is true, have had its streets kept in order during the time; but its condition is very likely to be such, when the last instalment is paid, as to render the relaying of the whole pavement immediately necessary.

SUCH a pavement as this does not seem to the Corporation advisers of Philadelphia economical, and there are other objections to it, which lead the engineers to prefer in all cases pavements of impervious materials. Among these they choose three sorts, each of which is adapted to certain conditions. For all streets less then twenty feet wide from curb to curb, or where heavy wagons are likely to pass at the rate of more than fifty an hour, they recommend a pavement of granite blocks, set on edge, from three to four inches thick, six, seven, or eight inches deep, according to the amount of travel, and eight to ten inches long. These should be laid on a six-inch bed, either of concrete or of clean gravel, rolled to a smooth surface, and the blocks should be set in three inches of washed sand; and finally, the joints between them should be filled with a mixture of clean, dry pebbles, which should be heated if laid in damp weather, and coal-tar, of the variety known in the trade as Number five. This filling of the joints with impervious material is looked upon by the engineers as very important. If water can be prevented from penetrating the joints between the blocks, a substratum of gravel, or even of earth, thoroughly compacted, is, except for the heaviest traffic, nearly as good as concrete. So long as it is kept dry, the earth or gravel will remain in place, and no settlement can occur, and it is not until water reaches it that movements take place, resulting in inequalities of the pavement. Still, the risk of dislocations of the joints by the shocks from the wheels of heavy wagons is considerable, and in places where it is exposed to these the pavement does best upon a base of concrete. For wide streets, lined with

dwelling-houses, and with grades generally not steeper than fourteen feet to the mile, the report advises the use of either the Swiss rock asphalt or the artificial product made with powdered stone and Trinidad bitumen, spread in a thin layer over a foundation of concrete. As a cheaper substitute for asphalt, the report suggests the use of compressed asphalt blocks, on a foundation of gravel, which, though unsuited to resist heavy traffic, answer well for streets of a quiet character. For suburban streets the engineers find nothing better than macadamizing, if done in a proper way, instead of in the usual feeble and inefficient manner. With ten inches of broken trap-rock, as they advise, on a bed of sand or blast-furnace slag, for drainage, all well rolled down, without the use of soft binding material, we know that a road can be made such as the dwellers in ordinary suburban districts seldom see, and it would be well worth while for some of the improvement societies which are doing so much good all over the country to inform themselves as to the economy of such work in comparison with that about them.

THOSE persons who are interested in meteorology may derive a suggestion from the description given in *Engineering*, of a "sunshine recorder," exhibited in the meteorological section of the Health Exhibition, by Mr. Leckey, of London. In substance the instrument consists of a solid ball of transparent glass, mounted in a frame which carries also portions of three rings, joining at their edges. The middle ring is a portion of the surface of a cylinder, the axis of which is parallel to the axis of the earth, while the breadth of the ring is so great that the image of the sun thrown upon it by the ball, acting as a lens, will fall always within it for about a month at each equinox. The other rings are portions of the surface of cones, whose common axis is parallel to that of the earth, and passes through the centre of the glass globe. The rings are made with grooves, so that cardboard slips, divided for hours and half-hours, can be inserted in them. On setting the instrument in such a position that the image of the sun at noon will fall upon the proper division of the card, not only does the movement of the image serve to indicate the time, but the concentrated rays scorch the card where they touch it, producing a brown line, which shows accurately the duration of sunshine on any given day, and the hour when clouds may have come up or cleared away. The records made by the instrument are easily preserved, and must have considerable scientific value. A series of such records, taken in Bedfordshire during the past three years, is given, and contains some interesting information. According to this, the gloomiest part of the year in that part of England is winter, the three winter months being nearly equal in regard to the proportion of clouds to sunshine. In 1883, the darkest month was December, which had only twenty-three and three-quarters hours of sun during the entire month. In 1882, December was also the darkest month, but in 1881, February, which is often one of our brightest months, was the darkest in England, the sun shining but eighteen and one-half hours in the forenoon, and nineteen hours in the afternoon. The whole of 1883 was gloomy, the average for the year, which no month much exceeded, having been less than one day of sunshine to every two of cloud. Some parts of England would probably show a brighter climate than that of the spot where the record was taken, but the southwest coast would be quite likely to be darker still.

ONE of our exchanges thinks it worth while, considering the present low price of copper, for those interested in metal-work of various kinds to consider whether this excellent material may not, with advantage, be used in place of iron for purposes to which the latter is but imperfectly adapted. As every one knows, many roofs still exist in perfect condition in our eastern cities, which were covered with copper fifty or sixty years ago, and to all appearance they will be good for as many years more; while some in Europe have remained for five hundred years. Although the first cost of such roofs was in their day very considerable, their durability has made them by far the most economical sort that could have been used in the trying climate of the Atlantic seaboard, and, as the price of copper is probably less than half as great now as it was then, it is well worth considering whether the fashion may not be revived. The journal which makes the suggestion sets the present value of rolled copper sheathing at seventeen cents a pound. This would make the cost, for material alone, of a roof of ten-ounce copper, ten dollars and sixty-two cents per square, and for sixteen-ounce copper, a very strong and durable material, seventeen dollars per square. The copper could probably be put on for eight dollars more, making the total cost twenty to twenty-five dollars a square. This, of course, seems a high price, but, independent of repairs, it would probably outwear half a dozen tin roofs, and the cost of these, together with that of painting them, would be about three times that of the copper. Moreover, the material of an old copper roof is always salable at a good price, while old tin, slate or composition is worse than valueless. In fact, the most serious objection which mechanics usually make to the employment of copper for this purpose is that it is likely to be torn off and carried away by thieves; but as copper gutters and rain-water pipes are extensively used without such results, it seems reasonable to suppose that plain roofing might also escape. Another way in which copper might be used is in the manufacture of stove-pipes. Such pipes are often made for tiled or other ornamental stoves, and handsomely finished by polishing, and are consequently expensive; but if made in the usual way, out of ordinary copper sheathing, their cost for equal weights would be little more than that of Russia iron pipe, and less than twice as much as that of plain iron. In fact, considering their value as old material, the copper pipes would probably be really as cheap as those of ordinary iron, even in first cost, while their durability would make them far more valuable.

AN old problem of the psychologists has been revived by a letter to *La Nature*, written by a French business man, who mentions that for years he has been in the habit of waking himself at any hour in the morning that he wished, simply by impressing upon his mind, before going to sleep, the fact that he must wake at that time; and saying further that he seldom varies five minutes from the moment which he had assigned himself. The New York *Evening Post*, in speaking of this letter, says that Napoleon I is related to have had the same faculty, but adds that its existence has never been verified. We imagine that this experience is not so rare as the *Evening Post* supposes, and that a person need not be a Napoleon to be favored with this useful "faculty." We have a very distinct recollection of many instances in which we have ourselves tried the experiment with success, and at one time, when it was necessary for a considerable period for us to wake on certain days of the week at a very early hour, to take the first train to the place where our services were then needed, we had an opportunity of studying the circumstances under which this peculiar species of self-control is most easily exercised. During this period we found no difficulty in waking regularly within about five minutes of the time necessary to enable us to reach the train comfortably, although for a portion of the time this involved getting up long before daylight; but we discovered, also, that in order to wake with precision at the right moment, and to rest quietly until it arrived, it was necessary to look at our watch just before going to sleep. If we neglected this precaution we were apt to sleep uneasily, waking first an hour or more before the proper time, and allowing ourselves, in conse quence, only short naps afterward until the minute arrived for getting up. Whatever part of our mind it might have been that took charge of waking us seemed to begin its count of the hours from the time at which we composed ourselves to sleep, and if we did not inform ourselves of this, our unconscious reckoning was correspondingly uncertain, and the effort to wake vague; but if we took a clear note of the time in the evening, we could sleep peacefully through the whole of the allotted interval, sure of being aroused at or very near its expiration. Another condition of waking we found to be the occurrence of some small external event, through which, as it were, the internal effort could take effect upon our senses. A very trifling circumstance — the flutter of a leaf outside the window, the chirp of a bird, or any other of the unnumbered sounds of early morning, was sufficient, if it happened at the right time, to wake us, by a sort of magnifying process which at that moment gave the power of startling us by a noise which would at other times be unnoticed; but without such sensible impression we think we should not have waked. In fact, on one or two occasions we remember to have been impressed with a dim consciousness of waiting for something to happen before waking, and a moment later a trifling sound would open our senses with a little shock. To the necessity of waiting for this impression, small as it might be, we were disposed to attribute the variation of a minute or two either way from the exact moment assigned for waiting, which might otherwise be kept with exact punctuality.

BRICK-CLAYS AND BUILDING-BRICKS.

CLAY suitable for the manufacture of building-bricks is an abundant material, and it is found, combined with other substances, in beds of varying depths, the term clay being applied to hydrous silicates of aluminum, and is produced for the most part by the wearing down and decomposition of felspathic rocks, and the precipitation in basins, from the suspension in water, of the finely-divided impalpable particles. The rocks containing a good proportion of oxide or salts of iron form red clays, and those having only traces form white clays.

The hydrous silicate of alumina or pure clay is infusible, even in the most intense heat; but when mixed with the alkalies or alkaline earths, it becomes fusible in proportion to the admixture. There is a great difference in the nature and quality of clay found in various localities. In Maine the clays are light; but they are more fatty in Massachusetts and Rhode Island; the Haverstraw, Croton, and other clays on the Hudson River contain an undesirable quicksand, and the stock made from them usually produces an undesirable efflorescence upon the face of the brickwork after the bricks are laid and exposed to the weather.

The building-brick clays of Connecticut and northern New Jersey resemble those of the Hudson River; but the belt extending along the eastern portion of Pennsylvania, down through Maryland, the District of Columbia and northern Virginia, contains the finest grade of loamy clay to be found on this continent, producing a superior quality of bricks of the greatest hardness and of a cherry-red color.

Baltimore and Philadelphia lead in regard to the quality and color of the finer grades; but the ornamental bricks produced in Philadelphia are of the highest rank.

The clay commonly used in Chicago and vicinity is not only limy, but contains lime-pebbles, which render it very difficult to work. Around St. Louis the material is of a loamy nature, with veins of what are called "joint clay," which makes the bricks crack and check in drying, and split in burning. In the neighborhood of Milwaukee the clays are of a smooth, plastic nature, and owing to the slight traces of iron burn nearly white or a light cream color.

In many portions of Canada the clays are good for making building-bricks; they are especially so in the neighborhood of Amprior, Bellville, Bell's Corners, Brantford, Dundas, Glenwilliams, Kincardine, Loudon, Pembroke, Ramsay, and Yorkville in Ontario; and near Little River, Montreal, Quebec, and St. John, in Quebec; also at St. John and many portions of New Brunswick. The clays found near Halifax, Springville and Woodstock, in Nova Scotia, are passably fair for making building-bricks.

Cuban and South American clays are generally poor, both as regards strength and color. In the northern part of France the clays are loamy and of a fair quality for brick-making; they are not deep, averaging only about two metres in depth; but they gradually improve in both quality and depth toward the southern portion. The Italian clays are of a superior quality for brick-making; they are naturally plastic and require no sanding.

In England, in the vicinity of London, the principal supplies of brick-clays are obtained from the alluvial deposits lying above the London clay, the blue clay not being much used for brick-making. The material employed is a kind of granite loam, weak on the surface, and formerly gradually passing into either a strong clay or marl, or, as it is usually called, "malm," which is an earth suitable for making bricks without any additions; but now there is little natural malm to be had, as this class of clay is about exhausted. For making the best quality of bricks, which are called "malms," an artificial substitute is obtained by mixing together chalk and clay, previously reduced to a pulp in a wash-mill; this pulp is run off into shallow pits, where it remains until it has become of sufficient consistency for subsequent operations, but this process is only resorted to for the best quality of bricks, as the expense is too great for the commoner kinds.

The clays of Germany are plastic and produce a superior quality of bricks. The Dutch clinkers, or paving-bricks, have for many centuries been of the hardest kind and of a superior quality, and are manufactured principally at Moor, a village about two miles from Gouda, in South Holland, the principal brick-fields being on the banks of the river Yessel, from which the chief material is derived. This is no other than the slime deposited by the river on its shores and at the bottom. The slime of the Haarlem Meer is also extensively used for this purpose, and the men who collect this in boats have long poles with a cutting circle of iron at the end, also a bag-net with which they lug up the slime; and the hard paving-bricks used for the streets in many portions of the Netherlands are made with a mixture of this slime and sand.

The London brick-makers obtain their supply of sand from the bottom of the river Thames, near Woolwich, where it is raised into boats used for that purpose.

The manner of taking material for brick-making from the bottoms of rivers and lakes with poles is not of modern origin, as will appear from the inscription which once stood upon the brick pyramid of Howara, ten leagues from Cairo; for Herodotus cites the following as at one time standing upon it, the translation reading: "Do not undervalue me by comparing me with pyramids of stone, for I am better than they, as Jove exceeds the other deities. I am made of bricks from clay brought up from the bottom of the lake, adhering to poles."

Clay of a superior quality for brick-making abounds in nearly every portion of Russia, and although brick-kilns are scattered all over the empire, the total production for 1880 was only about 750,000,000, which quantity would not more than supply the demands of the city of London in a busy building year.

By reason of the country's great wealth of timber, the production and consumption of bricks are by no means in proportion to the population of Russia. Wooden buildings are the rule and those of brick construction the exception, nor do the disastrous and too constantly recurring fires, with their attendant train of misery and suffering, seem to have much effect in enlightening the people.

Clay is the only substance in the mineral kingdom that possesses plasticity, and if sand be in large proportion in loam, or if calcareous matters predominate in marl, so as to deprive either material of plasticity, it is no longer clay.

Those clays which possess a high degree of plasticity are called long or fat, but when having but little plasticity they are termed short, meagre or lean; but in the language of the brick-yard the first is called "strong clay," and the latter "weak clay."

Mixed with considerable water, clays are more or less plastic, the degree of plasticity depending on their purity and peculiarities of composition, and, if possible, they should not be hauled into the brick-yard, dried by a scorching sun or drying wind, but in their moist and natural condition; for as they shrink and harden in drying, the labor of tempering them into brick pug is largely increased, and then it is not so good, the plastic nature of the clay being less smooth and free than before.

Oxide of iron, lime, magnesia, potash, silica, bitumen, and fragments of rock are substances that impair the plasticity of clay, and they impress upon it certain characters that are of much importance to the manufacturer, and as the plasticity of clay, or its power of yielding with water a mass that may be moulded, is of much importance in a practical point of view, and besides is interesting as a subject of scientific inquiry, we shall enlarge upon it somewhat.

Bischof explains the plasticity, and Aron the shrinking of clay as follows: Aluminum hydrate, like silicic acid, is capable of assuming the gelatinous form, in which, owing to the peculiar arrangement of the atoms, these compounds are able to take up a large quantity of water, swelling out to an extraordinary degree, and thus enveloping or binding together sandy or earthy matter in a fine state of division. On removing the water by drying, the original plastic mass shrivels up; this is termed shrinkage.

Either on drying in the air or on burning, the atoms of clay approach one another more closely, the accompanying admixed constituents also at the same time being drawn together. An increase of density and diminution of bulk thus occur.

The capacity for absorbing water in different clays varies as greatly as their plasticity, which increases with their tendency or power to crumble (possibly with the formation of aluminum hydrate). Meagre clays readily absorb water, and easily attain the desired degree of plasticity; fat clays, on the contrary, become very friable. The former become softer by working; the fat clays stiffer. Many fat clays exhibit the phenomenon technically known as "water stiffness," that is, when softened with a certain quantity of water, they have no inclination readily to absorb more. Shortness or meagreness depends more upon the presence of undisintegrated mineral particles than on that of sand; a clay rich in sand may, however, be fat; but one rich in unreduced mineral matter never can be.

By gradually drying at a temperature increasing to 266° Fahrenheit, the weighed portions of clay being placed on a glass plate, and two parallel marks cut upon it, and the distance between the marks repeatedly measured, it was found that the shrinking did not continue until the clay was quite dry, but ceased before this point was attained.

To a certain point the shrinkage exactly expressed the loss of water; at this point it suddenly stopped, just as the clay particles came into contact. Aron terms this point the "limit of shrinkage," and distinguishes the water dissipated to this point as the "water of shrinking," and that subsequently driven off as the "water of porosity." The sum of the two is total water. The cubical amounts of shrinking of a pasty mass of clay were found to be equal to the volume of water evaporated.

The proportion of pores in the dry clay is constant, that is, independent of the water originally contained. From the fact that the proportion of pores in several chemically different clays is nearly equal, it may be inferred that the smaller atoms of clay have a regular spherical shape, and this view is confirmed by microscopic observations.

In a plastic mass of clay there is thus a vast number of these little spheres, at equal distances, suspended in water. The distance

between these particles is so small that the attraction between them is considerable, and so a system of capillary tubes is formed, in which the expulsion of water by pressure is so opposed that neither the power of attraction of the spherical atoms for one another, nor their vertical downward pressure, will permit the water to penetrate through the tubes. Plasticity commences with increase of the distance between clay atoms, and ceases when that increase has attained a certain amount. In shrinking, as water evaporates on the surface, a fresh supply is drawn from the interior of the mass, through the fine capillary tubes mentioned above, the particles approximating throughout the whole mass, in obedience to their power of attraction; and this process continues until the atoms come in contact, and then room for water is afforded only in the spaces between the particles (water of porosity). In meagre clays these fine spherical atoms envelop the irregular-shaped particles of foreign matter. On trying the effect of additions of very fine sand to some washed clay, it was found that, to a certain point, the shrinking power of the clay increased with its progressive meagreness (the water being constant), and the porosity decreased. This point is termed the "point of greatest density of the mass."

From the point of greatest density, further impoverishment diminishes the shrinkage for an equal amount of water in the pores, but increases the porosity.

The best building-brick clays are composed of silica three-fifths, alumina one-fifth, and the remaining one-fifth of iron, lime, magnesia, soda, potash and water; if there is an excess of alumina over the silica, the bricks are likely to crack in the kiln, but the presence of a proper proportion of silica remedies this, by rendering the bricks more porous, and good building-bricks have been produced when the proportion of silica reached as high as eighty-five per cent of the whole body.

When sand is added to the clay intended for common bricks, it should be clean, sharp, fusible, and not too fine; right selection and proportion insures a hard, strong, ringing brick of good size and color, but for pressed, ornamental, and other higher grades of bricks, a finer sand should be used.

To be acquainted with the chemical qualities of brick-clays is of course useful in their manipulation; but the physical tests of this class of clays are of vastly more importance. Analyses answer well for comparisons in theory; but the physical trials and results are the ones which govern their employment in industry.

The actual quantity of sand or other substances to be employed, and which are required for any clay, can only be determined by actual experimental mixing and burning. Sandy clay or loam, and calcareous clay or marl, are largely used for brick-making; but if too much lime be present, the compound becomes too fusible. Oxide of iron is always present in building-brick clays to a more or less degree, and in the process of burning it is converted into peroxide, and imparts to the whole its color, more or less deep red, according to the degree of heat which the brick receives in burning, and the amount of oxide that the clay contains.

Clays that are rich in lime or in the alkalies are not good for brick-making, and are the worst that can be used for that purpose; in fact, when a clay contains even three per cent of lime, a good quality of brick cannot possibly be made from it.

Carbonate of lime, diffused limestone and lime-pebbles, when they are present in brick-clays, are a decided hindrance to the production of even a passable quality of building-bricks, for in the kiln the limestone and lime-pebbles are converted into caustic lime, and when the bricks are used below ground, or for exposed walls, the moisture and carbonic acid, which penetrate to every part of a brick, slack the nodules of lime, the swelling causing the bricks to burst and break to pieces. Should such bricks be used for "filling in," or inside or unexposed walls, the dampness from the mortar used in laying them, and also that contained in the plastering, would, by producing the same bursting and breaking, destroy the finished face of the inside walls.

These are some of the evils which result from the badly-made bricks so freely used in Chicago, and arise from the large amount of lime-pebbles in the clay, and the neglect of finely pulverizing or thoroughly sifting the clay, which easily can be done by machinery, at but a small additional cost. Oyster-shells and iron pyrites are not uncommonly present in clays, and in order to make a durable and well-colored brick, they must be separated from the clay.

Clay taken from the seashore, or without or beneath the seawashes, or from places in or near salt formations, will not burn into good bricks. Before they receive sufficient heat to burn them into hard bricks they will fuse, warp, twist, and agglutinate together upon the surface, and in the arches of the kiln they "run" or melt quickly into unshapely masses of molten clay, and form "burs" or clinkers.

A very interesting, but unfortunately a very little understood, class of phenomena takes place when bricks made from the material which we have just considered, or those that contain small quantities of it, are exposed to certain conditions. I mean the saltpetre exudations which effloresce on the exposed faces of brick walls. But we cannot enter upon a discussion of that matter in the present article, for want of space, but hope to treat it separately at a future time.

Clays containing a large amount of carbonaceous matter naturally mixed with it are very objectionable, as bricks when made from such clays will, when wetted in the wall, pass out soluble compounds, which discolor the walls, whether they are painted or not, and plastering or stucco-work is discolored by them the same as when bricks which have once been used in the inside of a chimney-flue, and become blackened, are re-used in new work.

It would be useless to attempt decorative work of any description upon brick walls the materials of which contain a large amount of carbonaceous matter, or if the bricks be made from the alluvial mud of the embouchures of rivers, as no possible precaution can prevent the entire destruction of the work.

The argillaceous earths that are generally suitable for the manufacture of building-bricks may be divided into three classes, viz.:—

1. Loams, which are light, sandy clays.
2. Pure clays, principally composed of alumina and silica.
3. Marls, which are earths that contain an unusual proportion of lime.

It is not often that earths are found that are suitable *per se* for brick-making; they generally require mixing with something else, as the loams are usually so open that, in order to bind the earth, a flux in the nature of lime has to be added, and if it happens that a loam requires no mixing, the difference in the working of adjacent strata in the same field is so great that in order to produce regularity in the size and color of the bricks, it is necessary to mix and temper two or three different kinds together, and for the same reason, and to prevent "checking," the pure clays also require mixing with some milder earth, loam or sand.

In working marls, great trouble is experienced from skerry or impure limestone, which abounds in marl; for should a very small piece be allowed to remain in the clay, it is certain to destroy the brick into which it finds its way. To obviate these bad results, heavy iron rolls are used to pulverize the marls and the limestone found in them.

No class of clay freshly taken from its bed is in a condition to be at once moulded into tempered bricks, even if it be of suitable composition, and it should first be exposed to the action of frost, the water diffused through the substance expanding by freezing, and breaking it in every direction.

The longer the exposure is continued, the more effectually is the clay reduced, and the more easily tempered and moulded. But the digging of clay in the autumn is not always attended to; but to neglect it, however, is to run a great risk of having bricks made by the hand-process unsound, as well as faulty in shape. The entire process of brick-making by the hand-process may be classed under six heads; viz., 1, preparation of the clay; 2, tempering; 3, moulding; 4, drying; 5, setting the bricks in the kiln; 6, burning.

The preparation of the clay commences in the autumn, immediately after the other work of the brick-yard ceases. The vegetable soil is stripped from the top of the clay and carried to the level places where the bricks are moulded, called the "floors," and uniformly spread over them to the depth of two inches, and by the return of the brick-making season, about the middle of April, the soil has become solidly packed. The face of the clay-bank having been "trimmed" so as to present a vertical face, it is then measured off in "benches," that is, in sections usually sixteen feet long, and running the height of the clay-bank. In yards making bricks by the hand-process, all work is done by the task or contract, and the clay is dug by "the thousand," and the usual price is fifteen cents for each thousand of clay dug, "one thousand" meaning clay sufficient to make one thousand bricks.

In computing clay it is estimated that there is required sixty-four cubic feet of clay to make one thousand bricks; but it does not require in fact more than fifty cubic feet of clay, on an average, to make one thousand bricks; sixty-four cubic feet to the thousand was about the quantity when our bricks were made of the same size as those of England.

Benches of clay are laid off sixteen feet long, and four feet wide, every foot in height counting as one thousand of clay. In the United States the common manner of digging clay is to undermine the face of the bank of clay, leaving small pillars called "legs," one at each corner, and one in the middle; chambers are next cut into the bank at each corner, the legs of clay are next picked out, a sharp watch being kept by the laborer to see that the bank of clay does not fall unawares. If it should not fall while the legs of clay are being picked out, the laborer gets on top of the bank, and driving a crow-bar into the clay, on a line in several places, about four feet back from the face of the bank, "throws" the bench of clay. The material is then picked into lumps and thrown back with the hands, the fine clay being thrown back with the shovel; and the face of the bank is picked regularly, and the bottom leveled, after which the laborer is ready for another "fall."

While the clay is being dug, strips of clay about eight inches wide are left between the separate benches, they are not dug, and are called "combings;" and if the laborers are not very trustworthy there will be more "combings" than dug clay.

The second step is that of tempering the clay. To temper clay means to thoroughly mix it, and prepare it for the use of the moulder, who must have it in a condition not too soft, nor yet too hard; but in a suitable state of plasticity to be easily and solidly moulded into bricks.

The ancient mode of tempering was by treading the clay by the feet of men or beasts; but clay is now tempered by one of three ways: the first being by hand, the second by the pug-mill, and the third in a ring-pit. The hand-method of tempering is often employed for the manufacture of pressed or front bricks, and sometimes in country places it is employed in the production of common bricks.

The man who reduces the clay to a proper state of plasticity is called the temperer, and in the hand-method of tempering it is his place to throw the clay into a pile the day previous to its being used; and while he is spading the clay into a pile, he at the same time throws water upon it; this pile of clay, when finished for common bricks, contains material sufficient to make 2,333 bricks, and is called "a soak heap."

The next morning, before the moulder is ready to commence work, the temperer pulls a part of the "soak heap" down with a hoe; the portion of the clay thrown down is wetted with water, and turned over many times with a spade. Having done this for a while, he next trims the small pile of clay into shape, and commences to cut through it with an instrument called a "slasher," and any stone that he may strike with the slasher is picked out of the clay. After "cutting and hacking" the clay for a time in this way, it is again turned over with the spade, after which it is ready for the moulder. This operation is continued until all the clay in the "soak heap" is worked out, after which the temperer throws up another similar pile of clay which is allowed to soak through the night.

When hand temperers are employed, in addition to the work just described, they are required to turn up ten rows of the moulded bricks on edge, and, after they are sufficiently hard to wheel and pack them in the drying-shed. The common bricks made from hand-tempered clay are not so good as when made by the other methods of tempering as the clay is not packed together by any pressure in hand-tempering; and the bricks after being burned, are very open or porous. When the process is used for making pressed-bricks, the result is different, as the bricks after being moulded are pressed very solidly in a hand-press.

The next process for tempering clay is by the pug-mill, and to explain this method, I shall here have to explain the organization of the "moulding gangs" in yards producing bricks by the hand-process.

Each gang is composed of one moulder, one wheeler, and one boy called an off-bearer. The moulder shapes the bricks in thin cast-iron moulds from the clay brought to him by the wheeler, who obtains it from an opening in the bottom of the cylinder as it issues from the pug-mill; the boy "off-bears" or carries the bricks from the moulding table and lays them in rows on the ground called the "floor," where they are left to dry.

The pug-mill is an iron shaft with knives of the same material about eighteen inches long, two-and-one-half inches wide, and three-eighths of an inch thick, extending from the shaft in four directions, but so placed that one does not follow directly under the other. To trace the knives around the shaft would be like following the thread of a screw. At the bottom of this shaft, and all on the same level following consecutively are four broad curved pieces of iron called sweeps, pressers, or pushers, which terms are synonymous, and their use is to force the tempered clay through an opening near the bottom, in the side of the cylinder or box inclosing the pug-mill.

The pug-mill and cylinder enclosing it are so placed that the pivot or spindle at the bottom of the mill will be in the centre of the diameter of a semi-circular pit, which to contain clay for three "gangs," measures eight feet from the centre of the pug-mill shaft to the face of the pit, which is four feet deep. This semi-circular pit is usually walled around with bricks, which should be hard burned, and the bottom formed of two-inch oak planks, cut wedge shape.

Directly in front of the pug-mill there is a fan-shaped hole or pit, which allows the wheeler to cut the clay away with a spade as it issues from the hole in the side of the cylinder at the bottom, inclosing the mill.

If the pug-mill is turned by a horse, it is usual, if the clay bank is too far away to be conveniently filled with wheelbarrows, to harness the animal to a cart, and haul the clay to fill the pit, after the work of grinding has been completed, which usually requires about six hours. A long pole fixed in a yoke in the top of the shaft is the leverage by which the pug-mill is turned.

The pit around the pug-mill, when the clay is ground by horse-power, holds usually material sufficient to make 7,000 bricks; after the pit is filled it is the duty of the temperer to let sufficient water to the clay to soak it.

The third manner of tempering clay is by the ring-pits, which are circular, and about twenty feet in diameter, two feet in depth, and they hold clay sufficient to make 14,000 bricks; they are cased around with hard-burned bricks, and the bottom is usually covered with oak planks, cut wedge-shape.

In the centre of the pit there is a pedestal firmly planted, upon which the machinery that operates the tempering-wheel is placed. Ring-pits are operated both by horse and steam-power. There is a gearing of wheels so arranged as gradually to push the tempering-wheel from the centre to the outer edge of the pit, while the wheel is revolving around the circle, and when it reaches the outer edge to again draw it towards the centre.

After the clay is tempered in ring-pits, it is covered with large battened panels, made of light pine wood nailed together, the object being to keep the clay moist, and prevent it from drying on the top before it is used.

Laborers in the brickyards like to have the clay tempered in ring-pits, as they can go in separate gangs at any time, and commence work without waiting for a complement of gangs, which has to be done when pug-mills are used for tempering the clay. It is not unusual for brickyard gangs in the hot season of the year to commence their task at about twelve o'clock at night, when the moon gives sufficient light, and have their day's work of moulding done before seven o'clock in the morning; the ring-pits facilitate this more than does any other mode of tempering the clay.

The third step in the process of producing hand-made bricks is that of moulding the clay after it has been tempered, and this is performed in most of the Eastern States in light cast-iron boxes, having both the top and bottom open and unobstructed, and these moulds contain one brick, and are commonly slightly more than twice as long as they are wide.

The laborer, called the wheeler, brings the tempered clay to the moulder, and piles it upon a wooden stand in front of him. The stand, which is called a "moulding table" is about four feet square, and made in height to suit the moulder.

On the left-hand corner of the table there is securely screwed a piece of cast-iron, one-half inch thick, nine inches wide, twelve inches long, and turned up at one end and down at the other; this iron presents a smooth, plain surface for the bottom of the mould, and it is called the "moulding cleat."

The moulder in forming a brick pulls down on the table with both hands a lump of the tempered clay, then takes a handful of moulding sand in his right hand, from a tub close by, throws the sand over the lump of clay, works the clay and sand into a peculiar shape called the "warp," and dashes it with great force down into the mould which rests upon the moulding cleat, using both hands in the operation. Having done this and patted the clay into the corners of the mould, the moulder then takes an instrument somewhat resembling a plasterer's trowel, and called a plane, which he dips in water, and afterwards strikes off the clay piled above the top of the mould.

The boy called an off-bearer now takes the mould and the enclosed bricks, lays the brick on the "floor," scrapes the inside, and particularly the corners of the mould with a knife suspended by a string from his side. The off-bearer places the cleaned brick-mould in a tub of sand convenient to the moulder, and by the time another brick is made, he is ready to place it alongside of the other on the "floor." This is continued until there are fifty-eight bricks in the row, and the rows are continued until they number forty; then part of a row containing thirteen bricks is made, which completes the "task" of moulding. Each gang, for a day's work, produces 2,333 bricks, three gangs 7,000, six gangs 14,000 bricks, and so on.

The art of perfect moulding by hand consists in filling uniformly every portion of the brick-mould, and in so manipulating the clay and moulding-sand thrown into it, that the bricks shall contain no cracks or "sand flaw," and in so "planing" off the clay from the top of the mould that neither hollow nor swelling called a "belly," is made on the flat part of the brick. The usual time for a good gang to accomplish a day's task of moulding is from five to five and one-half hours.

A difference in the thickness of hand-made bricks is often caused by the wearing of the moulds, new moulds generally being used in the spring of the year, which generally wear thinner, until in the autumn they have lost from one-eighth to three-sixteenths of an inch in depth, and bricks made in the fall of the year being consequently correspondingly thinner than those made in the spring. The loss of one-eighth of an inch in the thickness of a brick may appear to be a very small affair; but is not so insignificant as it may at first sight seem. To lose one-eighth of an inch in one course of bricks in its thickness, is to lose one inch in height in every eight courses, or one foot in every twenty feet of elevation. In a medium-sized house, say twenty-five feet front by sixty feet deep, and sixty feet in height from foundation, to finish the walls being one brick and one-half in thickness, which, with chimneys and ordinary inside walls would girt about two hundred lineal feet, the loss would be about six hundred cubic feet of brickwork, or more than 10,000 bricks. The loss would also be in laying that extra quantity of bricks, and as the bricks and laying would cost in the neighborhood of, say $15 per thousand, a needless loss of about $150 would be inflicted either upon the owner or the builder, which would depend upon the circumstances governing the case.

This fact should be remembered, and engineers and architects having in charge large undertakings requiring a long period for completion, and great quantities of bricks, should expressly require that all moulds that are subjected to loss of depth, whether they be hand moulds or machine moulds, shall be renewed not less than three times in each season. This should be done for the protection of their clients, if they should happen to be furnishing the bricks, and if not, then for the good of the contractor; and also for the purpose of keeping the courses level and uniform throughout the work.

The fourth step in the process of manufacturing hand-made bricks is that of drying, and the first step in this operation is to turn those upon edge that were made the day previous. If there be no indications of rain the bricks are "turned up" early in the morning, and allowed to stand upon edge, exposed to the air and sun, until about four o'clock in the afternoon, when each member of the moulding gang "takes in his share," and carefully hacks them in the drying shed; usually there are each day hacked about eight courses high on edge, and the hacks kept separate to allow circulation of air. There is a space left between the bricks of one-half inch, and a "head" or pier is built at each corner of the "rows."

After remaining in the drying sheds for about two or three weeks, the bricks are generally in condition for setting in the kiln; but during rainy seasons it often requires a longer period to thus naturally dry the bricks. The fifth step is that of setting the dried bricks in

the kiln preparatory to being burned, and this work is generally done by a force of five men, called the "setting gang," which is composed of one foreman called the "setter," and four men called the "wheelers and tossers."

A day's work of this gang is usually to take 20,000 bricks out of the drying sheds, and wheel them to the setter, who places them in the kiln in a proper manner for burning.

In "setting out a kiln" the first bricks are set in the back arch, and arch bricks in setting are divided into four classes, viz.: the straight courses, pillar, hangers, and skintle bricks, the names depending upon the position which they occupy in the arch.

The arch is generally fourteen courses high, the bricks being set on edge, and one-half inch apart; the bottom eight courses of the arch are usually called the "straight courses," on the top of which are placed the projecting six courses forming the arch proper, and which are called the "over-hangers."

The "pillar" bricks are the ones between the straight courses, and the "skintles" are bricks set diagonally in order to tie the "over-hangers together. The row of bricks first set on the top of the arch is called the "tie course," and the fourteen courses, including the "tie course" first set on the top of the arch is called the "lower bench," and the next fourteen courses, which usually finish the height of the kiln, are called the "upper bench." "Forty-two high" is the way that the height of a kiln arranged as has been described is usually spoken of.

The bricks are now ready to be burned, or converted from a perishable into an imperishable substance, and this completes the sixth or final step in their manufacture.

There are various plans for burning bricks, such as hot-air, and combinations of gas and gaseous fuels, super-heated steam, and other devices such as annular kilns, etc., which although they are all good require a highly scientific knowledge of heat, its mechanical action, and many other things.

The old-fashioned open kiln is the kind commonly employed, and in these the bricks are burned either by wood or coal. The usual time for burning a kiln containing from 150,000 to 500,000 common bricks is about six days, and the period allowed for the kiln to cool is about the same length of time.

CHARLES T. DAVIS.

THE REYNOLDS MEMORIAL IN PHILADELPHIA.

PHILADELPHIA, September 18, 1884.

Ironwork to Entrance Gate of Penitan House (Andorra)

THE equestrian statue of General John F. Reynolds, erected by an association representing several departments of the Grand Army of the Republic, and aided very largely by the generosity of Mr. Joseph E. Temple, was unveiled and presented to the city with appropriate ceremonies to-day.

The statue is of bronze, is about twelve feet high, and rests upon a plain pedestal of polished granite of the same height. It stands at the left of the northern entrance to the new city-hall. It is the work of Mr. John Rogers, with whose work on a smaller scale the American public is familiar already, and was cast by Bureau Bros., of this city.

The occasion is one which invites to reflection on one or two questions, which assume considerable weight whenever a work of this importance is undertaken — whenever, in fact, the significance of a work of art which makes any serious claim to being regarded as ornamental, is considered in the light of the purpose which it embodies, as distinguished from the peculiar merit of the work itself.

The disparity between the artistic value of this statue and the feeling on the part of the community which has led to its erection, is so pronounced that one asks himself again how much it matters, after all, whether the work be good or bad, if only the spirit in which it is offered be the true and generous one.

General Reynolds is to Philadelphia and to Pennsylvania an ideal of soldierly and gentlemanly worth. He shares with General Meade the honors of Gettysburg, and his memory is perhaps associated even more closely with that field than that of his companion, from the fact that he lost his life upon it.

The city and State which he honored so much, the generation of men which knew the extent of the service he rendered, and the soldiers who followed him, unite to erect a memorial that shall speak to those who come after them of the esteem in which his memory is held. How much, asks the critic who wants to be good-natured, does it matter whether they erect an eyesore or not? How far is the idea embodied to be accepted in place of a tribute fittingly expressed?

The stammered and artless eulogy is sometimes the most eloquent of all. Shall not the faults of the sculptor also be forgiven in the same spirit? How far does the protest against art for art's sake merely, which some of us think cannot be made too strongly, mean something like this? For my own part I think that no better opportunity than the present to examine these questions is likely to occur for many a day.

As far as meeting the requirements of a work of great art is concerned, the statue in question is not much better than an eyesore; there will hardly be much discussion on that point. The conception is a school-boy's, the lines are awkward and angular, and from nearly every point of view from which it is possible to see the group, the mass is so utterly wanting in dignity as to be almost ridiculous. It is not the sculptor's fault, perhaps, that the statue is elevated on a pedestal which is too high for a work intended to be seen so near as this must always be; but it is somebody's fault, all the same, and is none the less to be noted because it is the commonest kind of a mistake in the treatment of equestrian statues.

The figure of the man is too small in proportion to that of the horse, and the loss of dignity which is apparent from this cause is still more emphasized by the unfortunate repetition of the lines of the rider's body by those of the neck of the horse. The head and the raised fore-foot of the latter are also very weak, and the surface modelling throughout is spiritless in the extreme.

It is to be hoped that the likeness of the General is good. I cannot answer for that, but have no doubt it is well enough, and only know that the head is commonplace, and is badly set on a body for the *woodenness* of whose treatment the modern dress, exacting as it is, cannot be held responsible.

How far are its artistic or inartistic faults to be forgiven or ignored, in praising the spirit which has raised it? For my own part, I think they ought all to be forgiven frankly, if the statue as it stands — that is, if it were fairly representative of American art — could be fairly taken as an example of what we in America can do at the present time. For after all, that is what the work ought to stand for, and we ought to be willing to have those who come after us judge our tastes and our attainments by just such monuments as this is. They will do so, whether we are willing or not.

The pity is that we have taken inferior work, when we might have done so much better. The thing to be sorry for is that in the selection of an artist for this important work another blunder has been added to a list that was quite long enough before. For there are sculptors in America who would have done much better than this, if they had been given the opportunity, and everybody who loves the arts has a right to complain when their claims are disregarded, and the honors and the plums go to inferior men. That is all. Let us set up the statue by all means. No form of memorial is so effective, moralize about it and hunt for substitutes all we like. Poor ones are better than none, and often have an interest that is quite pathetic, when they are characteristic and representative of those who erect them. Only let them be the best we can get, and don't let each new commission be another instance of failure to recognize ability when we see it, and of contented acceptance of mediocrity, when excellence is within our reach.

L. W. MILLER.

THE ILLUSTRATIONS.

LAWRENCE BUILDING, NEW YORK, N. Y.

THIS building, which is just receiving the finishing touches, is situated on the north-west corner of Leonard St. and West Broadway. The materials used, and the system of construction, give it a certain interest. The exterior is faced throughout with light buff brick, from Perth Amboy, and these, in order to incorporate them thoroughly into the piers, are bonded with courses of headers about once in fifteen inches.

The enrichments of the cornices, string-courses and spandrils, and the door and window dressings, are of terra-cotta, made from the same clay as the bricks, and matching them in color. Stone is used only in the window-sills and copings. The interior of the building exhibits the so-called "mill-construction" of an exceptionally solid type. In order to gain as much light as possible, the girders were spaced nine feet four inches from centre to centre, and the span being considerable, it was found necessary to make them 16 x 20 inches in section, to sustain with perfect safety the estimated load of 200 pounds per square foot. The timbers were obtained of these dimensions from Georgia, without much difficulty, but they are perhaps the heaviest floor beams in New York. The weight of the floors being thus concentrated at points somewhat widely spaced, the piers supporting the girders, although calculated throughout for a load of fifteen tons to the square foot, including the facing, were necessarily somewhat cumbrous, especially in the lower stories, and the plan was adopted of setting the mass of brickwork which composes them with its longer diameter toward the street, so as to give as much window space as possible between them. Thus, in the basement, the main piers are two feet four inches on the face by five feet in depth, the depth diminishing by four-inch offsets in each story above. This arrangement of piers gives a series of shallow bays on the street side, but enables the openings to be made much larger than is usual in brick buildings, without detracting in the least from the solidity of the structure; and the bays themselves are utilized in the first story for bulkheads, which give light and ventilation to the basement, and a place for displaying goods on top, and in the upper stories are found convenient for placing radiators and other furniture. The planking over the girders is of splined spruce, four inches thick, and this again is finished with an upper flooring of one-inch narrow maple. The whole of the surface of planking and girders is wire-lathed and plastered. Both elevators run in brick shafts, which are carried up high

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RADIATORS.

Funny, aint it? Why there are more Bundy radiators in use than any other? Why is it?

First, because the A. A. Griffing Iron Co. use their immense works exclusively for the manufacture of radiators for steam-heating contractors, all over the country. In heating buildings by steam, so many different styles, as to heights, sizes, and shapes are required for different jobs, large and small, that no steam-heating contractor would feel justified in procuring the expensive plant, machinery, and apparatus, and keep on hand the skilled labor necessary to get out the immense orders that are required at short notice, but he can use the facilities offered by the above manufacturers, and get radiators better, quicker, and at lower prices.

Second, these radiators are adapted to high or low pressure, and is the only radiator for the one pipe system.

Third, they circulate with feed and return at one end.

Fourth, they do not collect dust.

Fifth, They occupy less space, and can be made to fit any room.

Sixth, they can be made to meet any requirement in a radiator; can be easily changed for hot-water heating, and if extended surface is required, loops with extended surface can be built up on the same bases used for the plain surface, making the cheapest radiator in the market.

A. A. GRIFFING IRON CO.,
Jersey City, N. J.

QUARRYING SLATE BY THE USE OF MACHINERY.

In the slate district of Pennsylvania a machine has recently been introduced which bids fair to supersede the old method of drilling and blasting. The machine is the invention of John Crump, of Philadelphia, and of Richard Brereton, Superintendent of Mr. Crump's quarry. Mr. Crump four years ago proposed to himself the project of devising a machine to cut and finish with true surfaces all kinds of building-stone as it lies in the ground, thus saving the enormous waste of blasting processes and the handling of the waste. He engaged Mr. Brereton to assist him, and the result of their labors is this novel "Rock Quarrier and Stone Shaper," which they have had patented in all countries under the above name. Its cutting power is shown by the ease with which it goes through the flint in this slate quarry, where, at least, it is capable of doing remarkable work. Whether it can be as successfully employed in cutting and shaping granite and other hard rocks is not decisively proved as yet, though it is designed for such use.

The machine in its essential features is as novel as it is effective. It looks like a very coarse circular saw, but is not driven like a saw, and it makes its cut in an entirely different way. Thus, it runs backward, cutting upward instead of downward, moves very slowly instead of rapidly, and is driven not from its axle, as saws are generally driven, but from its periphery. The cutting disk is substantially like that of a saw, with removable chisel teeth. These have an alternate "set," right and left, and at intervals there is a straight tooth to clear out the sliver that the two sets of teeth might otherwise leave. Near the outer edge of the steel disk there are two rows of oval holes, in which the teeth of two pinion-wheels, one on each side, engage. This is the driving mechanism, and it serves two useful purposes. It applies the power at the most advantageous point, and it steadies the large, thin disk, one-half inch thick, while cutting through very hard rock, or rock containing hard particles of flint. The circular cutter is, in fact, simply journaled on its axle, and is pulled around by its periphery while making an upward cut. The feeding mechanism is worm-screws and cog-wheels, so geared with the cutter that they move in unison. The whole machine (including the boiler and the steam-engine for driving the cutter) is mounted upon one framework, and all of the mechanism travels together upon pinion-wheels, the pinions of which engage in holes in an iron track-way laid upon the rock to be cut. The depth of the cut made is nearly one-half the diameter of the cutting disk, and may be of any length that the quarry permits. The cutter may be set at any desired angle, and if the stone is to be finished before its removal, files are attached to each side of the saw-plate, slightly wider than the cutter, thus removing the saw-tooth marks.

The teeth of the cutter are, as before remarked, removable, and they are removed and replaced while the cutter is at work. The cutters do not get hot. The machine moves so slowly that a boy has plenty of time to take out a dull tooth as the saw comes up from the stone, and replace it with another before the part of the blade from which it was removed has again passed below the surface of the stone. A boy is employed at this work all the time, and, with a set of machines at work, the teeth are being constantly resharpened, ready for return to the cutting disks of steel. In the slate quarry the machine is said to work admirably. It makes a cut "across grain" about thirty-six feet in length, or with the grain seventy-five feet in a day, and of a depth proportioned to the diameter of the saw or cutter. There is practically no waste in quarrying slate by this process. It saves from ten to thirty tons of waste for each ton made marketable. Cross-cuts, leaving sharp square edges and corners, can be made, but in quarrying for roofing slate only lateral cutting is required. Two parallel cuts having been made at any desired distance apart, say two and one-half feet, a line is nicked out where it is desired to split off the block, and a few sharp blows determine the fracture. The blocks are then removed from the quarry, and at once split and shaped by expert workmen into roof-slate. All the work except the simple process of splitting and cutting to size is done in the quarry, and without handling or any waste except that of the saw-cuts. The slate, moreover, is removed without such incipient fractures as are liable to result from blasting and other violent processes of dislodgement. Roofing-slate is sold by the "square," a square being as much slate as will cover one hundred square feet of roof — say a space ten by ten feet. It is claimed that slate can be quarried by this machine and prepared for the market at from one-third to one-fifth the present cost, besides saving a vast amount of material that is now wasted.

JOHN CRUMP,
4 South Broad St., Philadelphia, Pa.

NEW ROOFS OF THE WILLIMANTIC COMPANY.

Some four years since the Willimantic Linen Company erected a shed covering some four acres of ground, one-story in height, lighted by long windows on either side, and also by what are called monitors crossing the roofs. The roof was supported through the centre by iron columns. The roof surface measured about 170,000 square feet. The roof was originally covered with what is known as English or Irish felt, which is a thick, coarse, porous material. In order to render it waterproof this felt was saturated with coal-tar. After the felt had been put in place the whole was covered with a coat of coal-tar, cement, and gravel. This roof in a short time became very unsatisfactory. Upon close examination its appearance indicated that the cement had softened and filtered through the felt, cementing the latter to the boarding. The felt had become dry by exposure, then had absorbed water when rain fell or snow laid upon it, and, finally, produced leaks, to the annoyance of

the occupants. Accordingly a new roof was ordered. The company contracted with the New England Felt Roofing Company, of No. 22 Milk St., Boston, for re-covering the roof. The English felt was removed, everything being taken away down to the boarding. Owing to the filtering through of the cement, it was found necessary to first cover the sheeting boards with a layer of dry sheeting paper. Over this three layers of "Bee Hive" felt were applied, and this in turn was coated with a layer of melted composition of the same brand. Over this in turn an additional layer of felt and a second coating of composition were applied. Above this still another layer of felt was placed, and over the whole a good body of melted composition was applied, into which was embedded clear, dry gravel. The usual care exercised by the New England Felt Roofing Company was taken in securing the felt to the roof properly, not only in the flat surfaces but also about the monitors. Zinc was used for flashing. The Willimantic Company believe that the present roof is one of the best and most satisfactory that can be applied to a building of this character. The number of layers of felt which has been applied, and the large amount of composition which has been used, indicate the thoroughness of construction.

NEW ENGLAND FELT ROOFING CO.,
22 Milk St., Boston, Mass.

TRADE CATALOGUES.

The catalogue of Keuffel & Esser, of New York, is a most useful book for any architect to have at hand who desires to use good drawing materials in his office, and here, as in other things, the best is usually the cheapest. An examination of the lists and illustrations convinces us that an architect in any part of the country might send an order to this firm for any instrument or material, of any quality, however uncommon, and feel reasonably certain that the earliest mail or express would bring to him the article he required.

If the article desired happened to be anything in the way of water-color materials, and the foregoing firm could not supply it, the architect could seemingly be sure of getting it from J. Marsching & Co., 27 Park Place, New York, whose catalogue offers a pretty complete list of German colors, dry or moist, in cakes or tubes, and a line of colors made up in cylinders especially for the use of architects.

The ball-trap manufactured by B. P. Bower & Co., 104–106 St. Clair Street, Cleveland, O., is now so well known and so generally used that it seems hardly necessary to distribute pamphlets describing its working, as ordinary newspaper advertising should be enough to keep it before the public mind. But if any one is unfamiliar with the construction and working of these traps, he can inform himself on these points by devoting a half-hour to the study of this little pamphlet.

Architects do not pretend to have much knowledge of mechanical engineering and to them a steam-engine is a steam-engine, and nothing more, but size, price and capacity they can understand and makers' catalogues, which like that of Heald & Morris of Baldwinsville, N. Y., will give this information in compact form, and are useful documents to keep on hand.

It would seem to be almost less difficult to get up a catalogue which should enumerate the architectural features that cannot be represented in galvanized-iron than to make a list of those which can be repeated, but as manufacturers of and workers in galvanized-iron, Messrs. Backwell & Mullins, of Salem, O., seem to have thought it for their interest to attempt the latter task, though it has taken a bulky pamphlet to contain the record.

Cincinnati, July 20, 1884.

Gentlemen, — Referring to the accompanying circular of the New York Iron Roofing and Paint Works we wish to say that having, through our extensive business in corrugated-iron, much inquiry for roofing of flat sheets, and having for years known well of the roofing sold by the New York Iron Roofing and Paint Works, which we consider unequalled for effectiveness, we have, at large cost, bought out that establishment.

We only ask that we receive equal patronage to that of our predecessors, guaranteeing to maintain the hitherto high character of this roofing to the fullest extent.

With this extension of our manufactures we are now undoubtedly the largest manufacturers of metallic roofing and siding in the United States, and having unequalled facilities, we offer the most complete line of inducements to purchasers. Respectfully yours,

THE CINCINNATI CORRUGATING CO.

Cincinnati, July 10, 1884.

To whom it may concern: —

This is to certify that we have this day sold our entire interest, patents, franchises, machinery and good will in the iron roofing business to the Cincinnati Corrugating Co., and recommend all our patrons to extend the same courtesies and patronage to said company that have hitherto been so generously extended to us. Respectfully yours,

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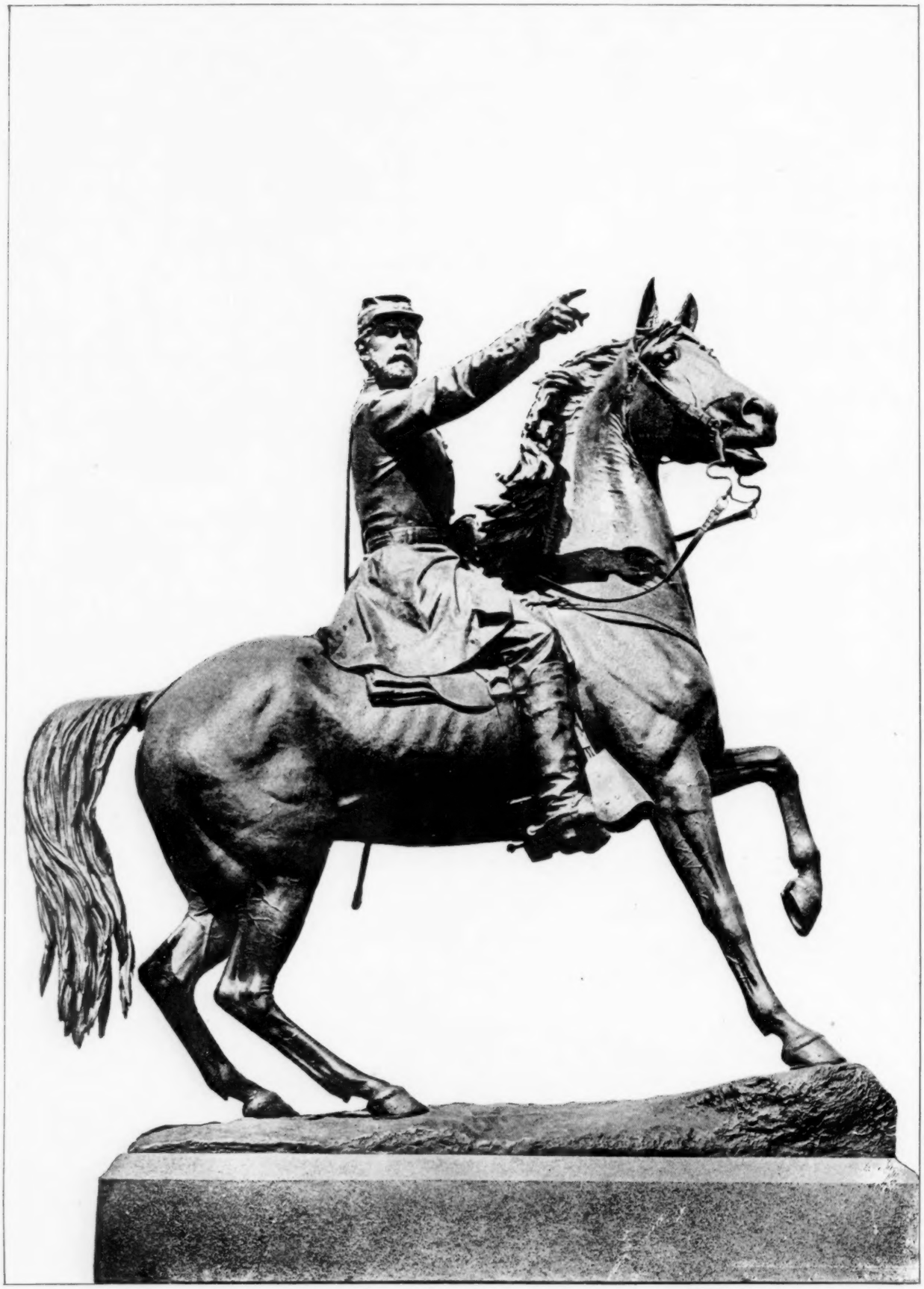

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GENERAL JOHN F. REYNOLDS, PHILADELPHIA, PA. JOHN ROGERS, SCULPTOR.

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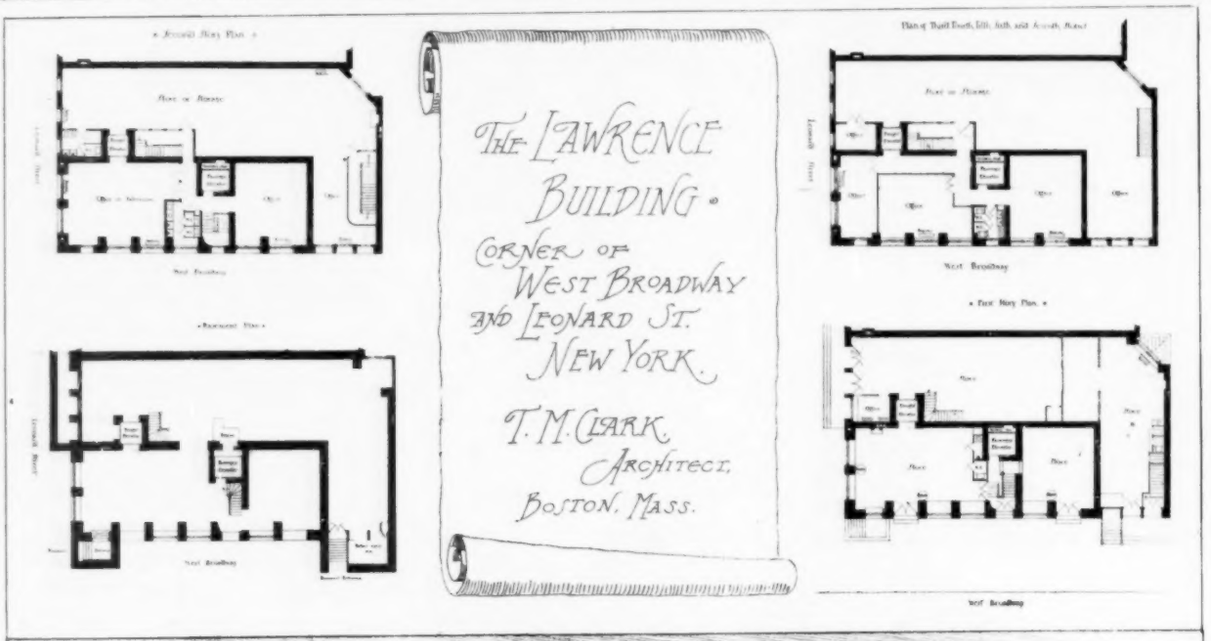

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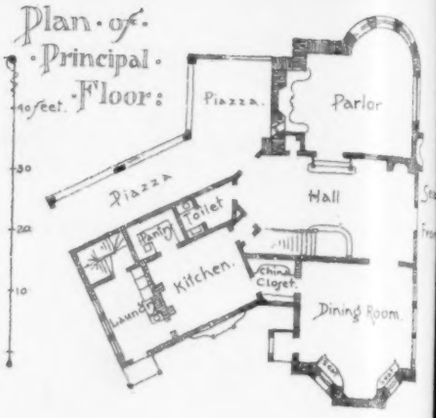


Dining Room Bay from below.

Dormer

Looking towards Porch from Dining

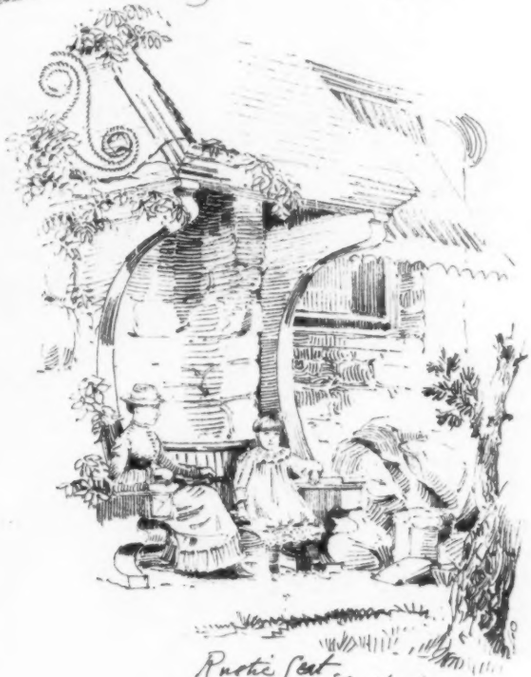
Principal Entrance.

Pencil Sketches in & around Manchester by the Sea: Mass:

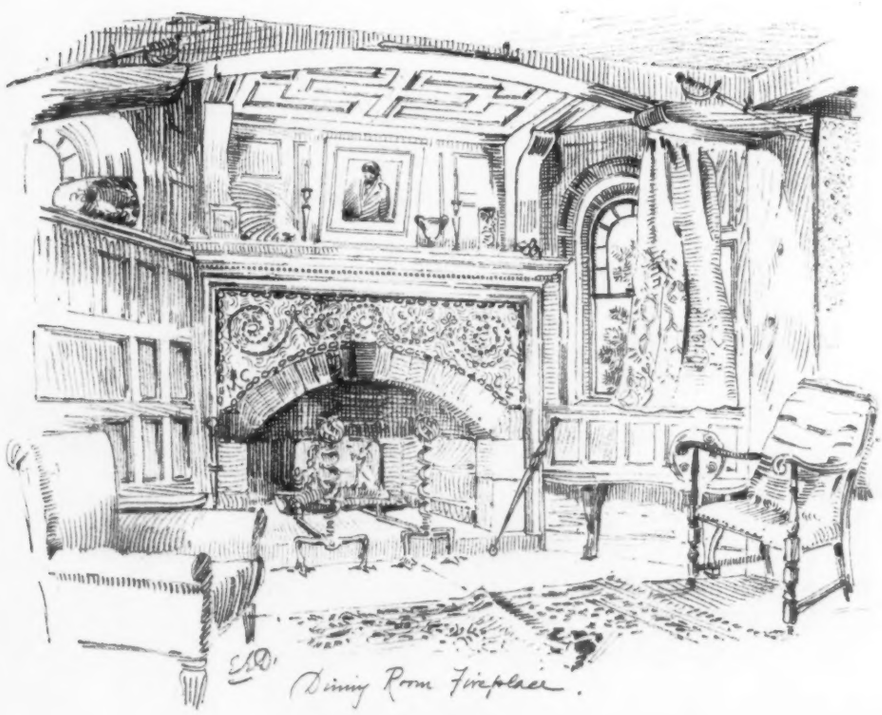
House of Gen.l Chas G. Loring. Mr W. R. Emerson Archt. Pride's Crossing.

by. E. Eldon Deane:

Gen.l Loring's House Pride's Crossing.



Rustic Seat on Sea Frontage.



Dining Room Fireplace.

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Wm. B. Tubby Arch't
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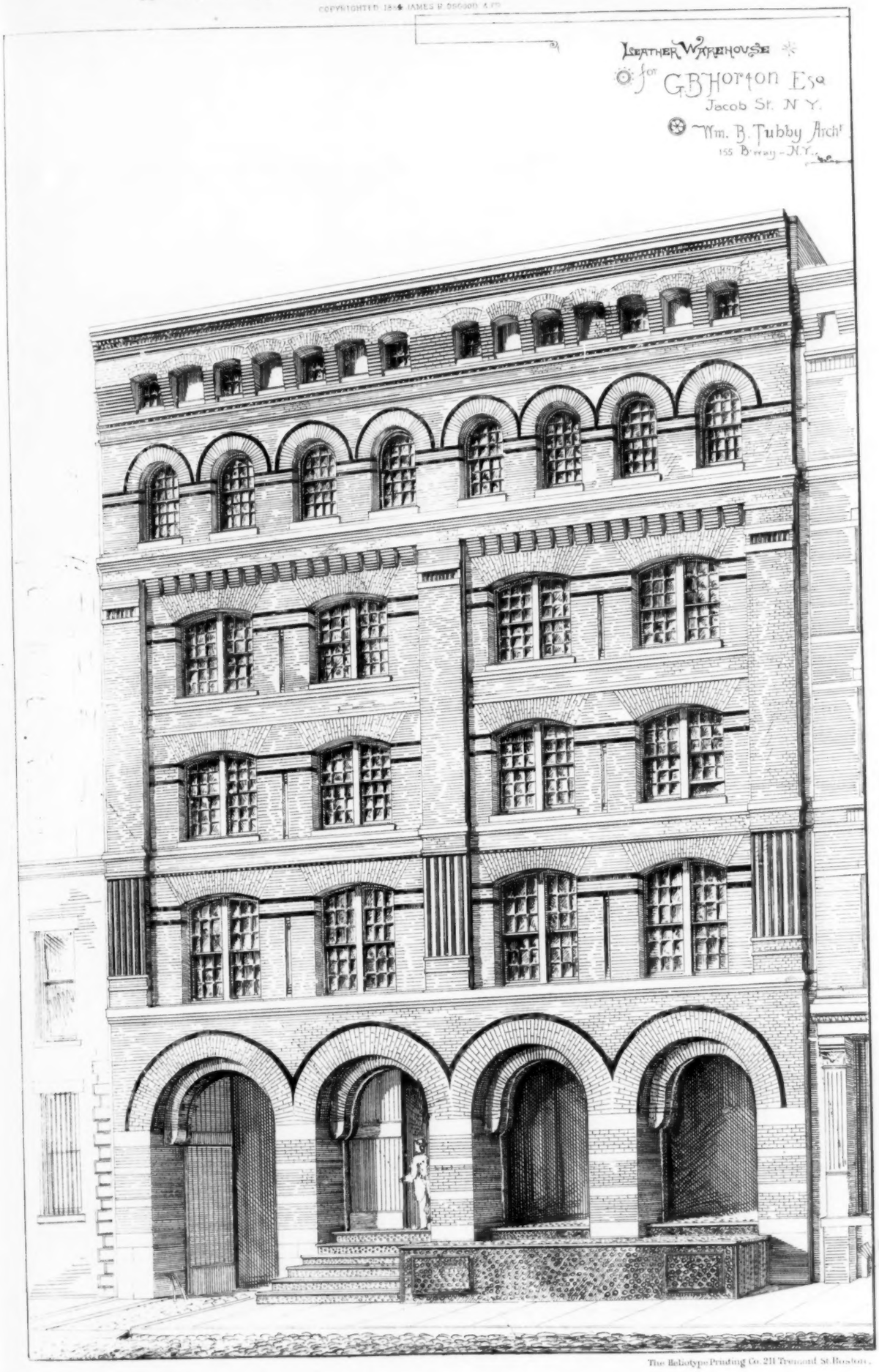

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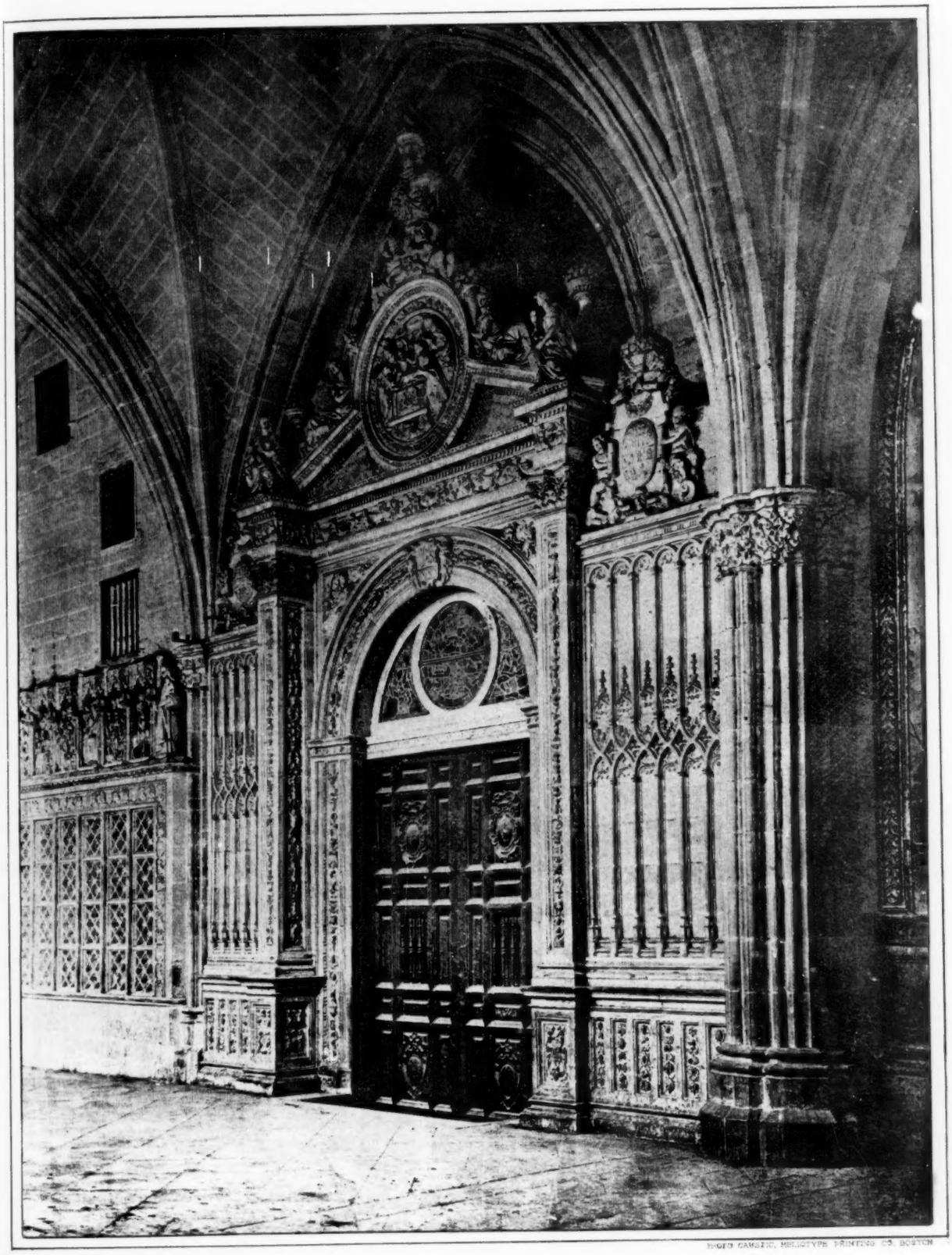

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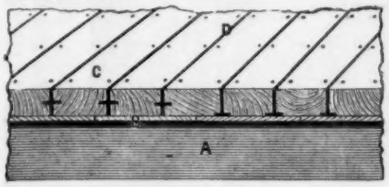

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The public are cautioned against all similar brackets, not marked with my stamp, as such brackets are infringements of patents held by me.

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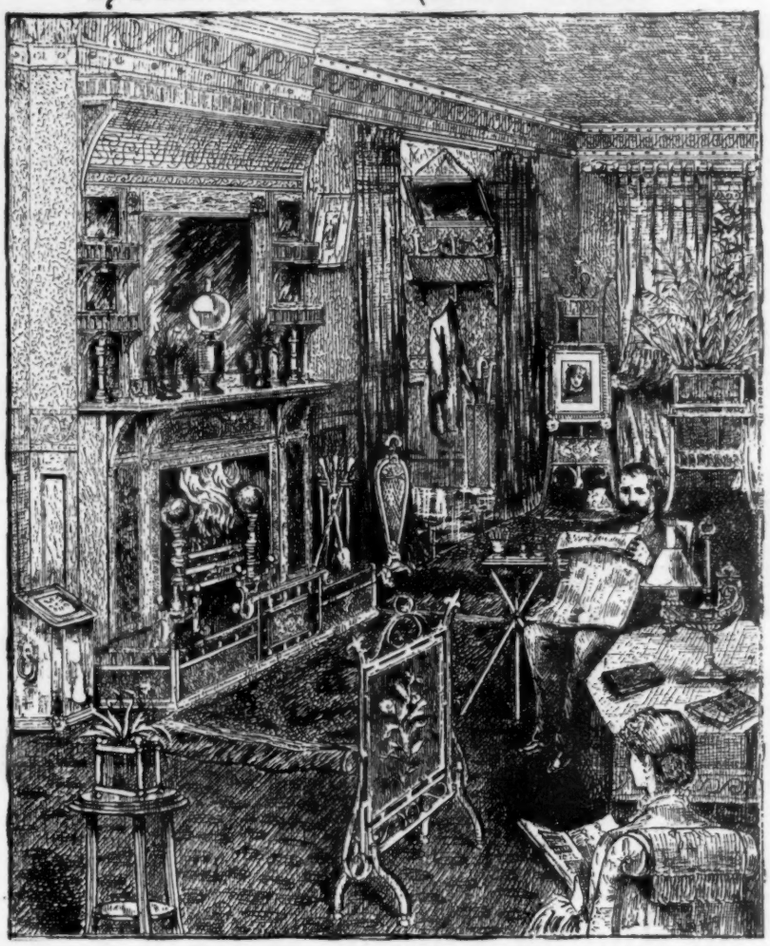

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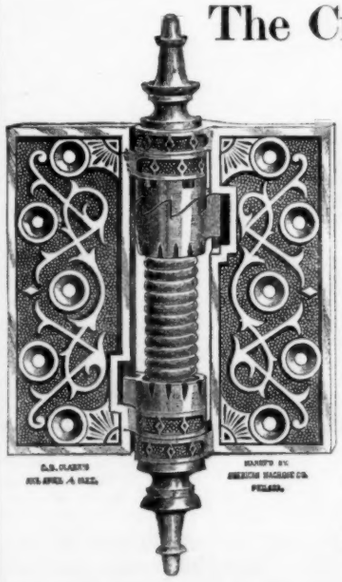

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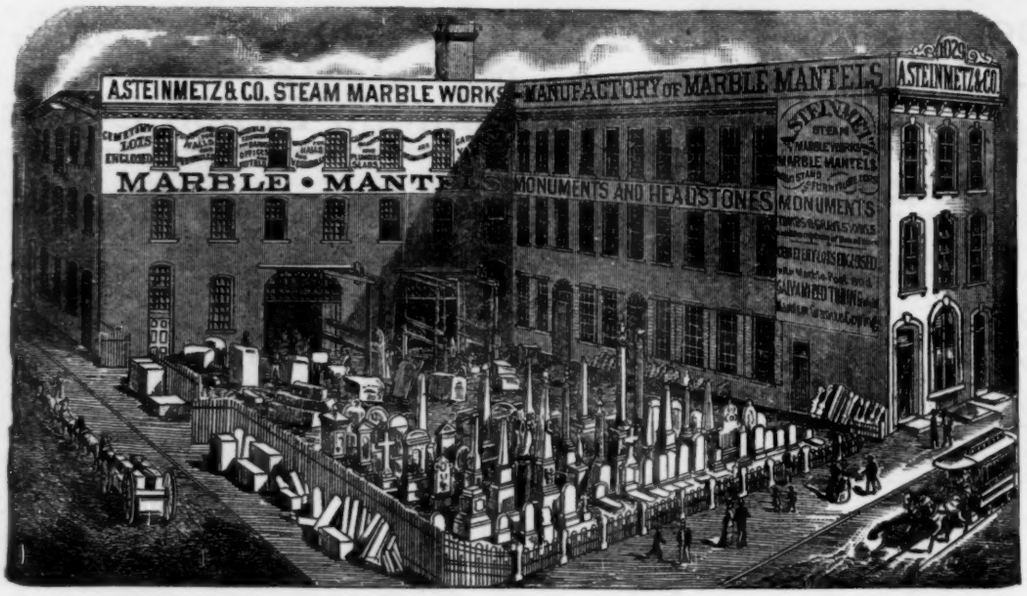

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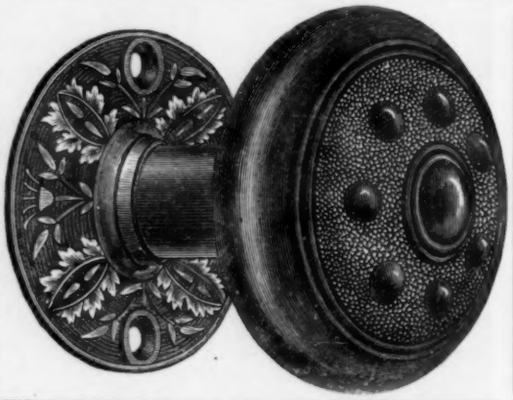

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Materials for complete roof, 2¾c. per sq. ft.
These felts are *thoroughly reliable*, smooth, clean and dry, easily applied by any one.
VULCAN ROOF COATING
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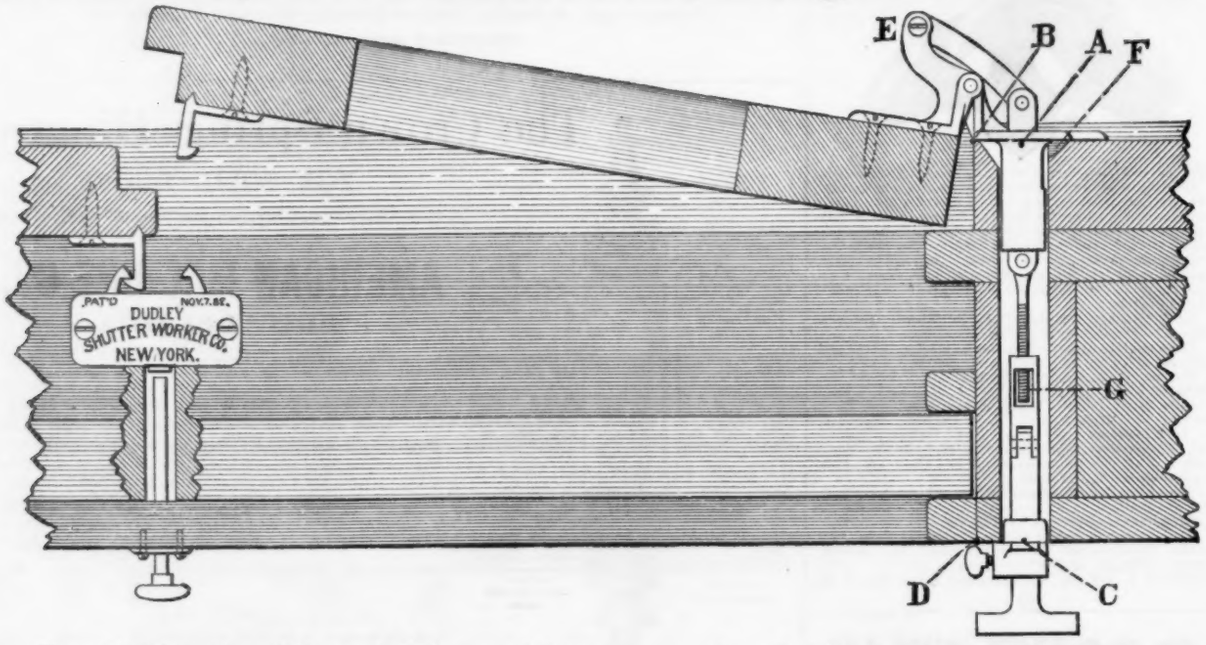

The attention of architects, builders, and house owners is called to the only practical fixture for opening and closing outside-blinds, from within the house, without raising the windows or removing window-screens. With each set of fixtures is furnished all the iron-ware necessary for hanging a pair of blinds. The hinges are the strongest and most durable of any in the market, they and all other parts of the fixture are made of maleable-iron and subjected to a process which renders them rust-proof. They can be applied to blinds already hung, as well as to new work.
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enough to enable passengers and goods, or materials for repairs, to be landed on the roof.

The heating is done by steam, on the direct-indirect system, each radiator taking a supply of fresh air from the outside through openings upon the windows; and a thorough ventilation is maintained by means of a shaft of fifteen square feet sectional area, which runs up at the back of the passenger-elevator shaft.

In addition to this, the plumbing fixtures, which are exceptionally abundant, are all ventilated downward through the outlets by means of a galvanized-iron shaft, heated by the exhaust from the engines, which runs through its whole length. This is not entirely a new device, but is sufficiently unusual to merit attention; and it has probably never before been carried out quite so efficiently and systematically as in this building.

One novelty is to be found in the doors to the shaft in which the passenger elevator runs.

The freight elevator shaft is prevented from acting as a conduit for fire in a sufficiently common way, by tin-covered doors to each opening, arranged to close automatically in every story, except the one in which the elevator may be actually in use at any time; and similar doors, made ornamental by covering them with polished brass, in a single sheet to each side of the door, guard all the openings to the passenger shaft. Light enough is obtained for illuminating the car, which is a very large one, from the skylight at the top of the shaft; but small, thick bulls' eyes of glass are inserted in the brass-covered door, to enable persons outside to observe the approach of the car.

The finish is of California redwood and native chestnut in alternate stories. The basement is made thoroughly water-tight by New's patent process, and has a floor of Swiss rock asphalt over a bed of concrete eighteen inches thick. Hot and cold water are laid into all the toilet rooms, and the building has been prepared throughout for electric-lighting by incandescent lamps, as well as for gas. The passenger elevator is arranged to run at the rate of two hundred and fifty feet a minute.

HOUSE OF GEN. CHAS. G. LORING, PRIDE'S CROSSING. MR. W. R. EMERSON, ARCHITECT.

The sketches are sufficiently indicative of the artistic features of this house. Perched on a prominent eminence overlooking the sea, resting on big boulders, the peculiarity of which determined its plan, it is approached on the sea-front by circuitous paths and rustic steps, cut out of the precipitous rocks, sheltered amidst rugged pines, so that only occasional peeps can be obtained of those happy bits suggestive of the artistic treatment of the whole, which one realizes on reaching the summit and examining this sea and woodland home. The fine pine woods lying between the house and Pride's Crossing on the Eastern Railroad, and through which the drives alone indicate the approach to these summer homes, are left in their natural and wild condition, so that a still feeling of restfulness and change dims the busy world we have left outside from our mind and gaze. There are several houses well worthy of the architectural student's observation and pencil, scattered along this coast, some of which will in due sequence be to some extent represented in these pages.

Sombre greens and browns predominate in the shingle covering of this house. A little touchy effect is obtained here and there in scroll ornament, of common rope nailed on to the boarding, oiled and painted. The interior finishings harmonize throughout. All the mantels are of refined design. The dining-room fireplace and mantel is most effective; the arch-stones are in the rough, with marble keystone, the scroll-work above being formed of colored pebble-work on the rough plaster, wavy indentations following the curves, a little powder color being thrown in as the work proceeded. This latter piece of ornament was the characteristic work of the architect's own hands.

EQUESTRIAN STATUE OF GENERAL JOHN F. REYNOLDS, PHILADELPHIA, PA. MR. JOHN ROGERS, SCULPTOR.

For description see preceding article.

LEATHER WAREHOUSE, FOR G. B. HORTON, ESQ., NEW YORK, N. Y. MR. WM. B. TUBBY, ARCHITECT, NEW YORK, N. Y.

DOORWAY IN THE CLOISTER OF THE CATHEDRAL, TOLEDO, SPAIN.

For description, see "Article on Spanish Architecture," No. VIII in *American Architect* of January 26th, No. 422, page 39.

The Proposed Jordan Canal.— It seems that the proposed Jordan canal, the plans for which have appeared in the foreign scientific journals, is not to be, in any proper sense, a canal, but rather a large inland sea, some three hundred miles long, with an average of ten to fifteen miles in breadth. The waters of the Dead Sea would be raised from their present level about 1,300 feet, and its area, of course, be largely increased. The river Jordan, the Dead Sea and Lake Tiberias would all disappear with some square miles of land, principally on the western side of the Jordan valley as now existing, and in their place would be a vast inland sheet of water, fertilizing the neighboring desert with the rainfall produced by the evaporation from its surface. According to this plan, therefore, there would be, instead of a simple canal, a wide open channel, traversing Palestine from north to south, navigable in every sense of the term, with safe harbors here and there on either side.— *Philadelphia Evening Bulletin.*

CEMENTS.

The cement trade of the United States has passed through the two stages of infancy and youth, and now in the nineteenth century walks as a stalwart man. In years gone by, science paid little attention to the manufacture of hydraulic cement. The parties producing it were to a certain extent ignorant of what they produced. They manufactured the article in a mechanical way. Nature had laid in the bowels of the earth a stratum of rock, the composition of which was allied with that class of material which experience said would make a fair cement. Old-fashioned crushing mills were built near these pockets of calcareous rock, the ordinary lime kilns were erected in a rude style, as close to the raw material as possible, and when all was in receiving order, the rock was brought from the quarry or tunnel, and dashed into the kilns at intervals, each layer being thoroughly covered with some combustible. Every twenty-four hours the kilns were drawn, the rock allowed time to cool, and then conveyed to a crusher which reduced it to granules; from there to a set of burs, where it was ground to the fineness of wheat flour; from these burs it was transferred to a large spout, and from thence to the delivery, where it was put up in barrels, holding three hundred pounds net, and in this form it was put upon the market.

Still, science prompted by competition asks for a superior article, something with more strength and durability, than can possibly be obtained from cement stones treated by the above process. We are glad to state that our manufacturers have answered the call, have remodelled their works, and are making cement by the most approved method, with the best adapted machinery, and are giving us an article which comes up to the standard of the nineteenth century. Notwithstanding all this improvement in manufacture, there are still afloat in our market inferior articles, against which we must protect ourselves. Now to do this with justice to all parties concerned, a standard by which to judge cements must be adopted; for without a code, recommended by the profession or scientists, those who attempt to pass judgment upon the superiority or inferiority of a cement will widely differ, though they be men of unquestionable good judgment and skill in their profession. The reason for this is, each one has a different *modus operandi*. We want similarity in treatment, the result will not differ.

Only a few tests of a commercial nature are necessary to determine the quality of a cement, which can be carried out in the following manner: If all the samples submitted for test will pass through a sieve of sixty meshes, leaving not more than five per cent, the cement is properly ground. Next proceed to make a briquette from which to ascertain the tensile strength. This operation requires some skill to obtain the best results in a legitimate manner from the article tested. An excess of water should not be used, neither should you have a deficiency; for the bonding of cement is a chemical action, and if too much water is used it is impossible to get a square inch of cement in the mould, because of the evaporation of water, hence porosity. While on the other hand if you have a deficiency, you set on foot a chemical action, which will be unable to complete itself; so it is evident that the result of your test will depend largely on the manner in which you have gauged your cement. Next comes the difficulty to tell when your sample is "set." The simplest and best manner to detect a "set" is to find that period, when by gentle taps with the soft part of the forefinger, the elasticity of the mass ceases, and the water cannot be raised to the surface by this gentle motion. The object to have in view in making a fair test, is to get the best results from all samples, representing the various brands; for made in any other manner, it will prove no criterion as to the quality of the cement.

"R. W. B."

Washington, D. C., September 13, 1884.

IRON AND CONCRETE CONSTRUCTION.[1]

Several experiments were made in London, in 1876, by Mr. Thaddeus Hyatt, assisted by Mr. Thomas Kirkaldy, author of the text-book entitled "*Experiments on Wrought-Iron and Steel*," on Mr. Hyatt's invention of combining wrought-iron bars as tie metal, and so prepared as to prevent any slipping when placed into and near the bottom (the weak part) of a Portland cement concrete beam in which they were enclosed, and became united to it.

The first application of the tie metal is capable of furnishing all

[1] Read before the Technical Society of the Pacific Coast, by P. H. Jackson.

the tensile strength needed to balance the compressive resistance of the other material, so that all metal may be dispensed with but the tie only, and either hard-baked bricks and cement possess in themselves cohesive power and strength sufficient to perform the functions ordinarily performed by a metallic web.

The improvement consists in preparing or making the iron ties with bosses or raised portions formed upon the surface of common bar or hoop iron, roughened or studded with pins, or several blades threaded on wires; the binding power of the cement holding them firmly in position, preventing the possibility of any slipping or sliding of the material one over the other, when the beams or structure is under strain.

For resisting the thrust of a bow-string girder or arch, a tie may be made dependent on the two end fastenings only; but with a straight beam the tie must be qualified to resist cross-strain equally well at any part, and it must of necessity be attached to the web practically throughout its entire length as firmly at one point as at another.

The object of such fastenings not being to prevent the tie from bursting away from the web in a downward direction because of such tendency, but to counteract the tendency of the shearing stress.

This discovery of the true relations existing between a tie and its web, also demonstrating the sufficiency of the cohesive power of the

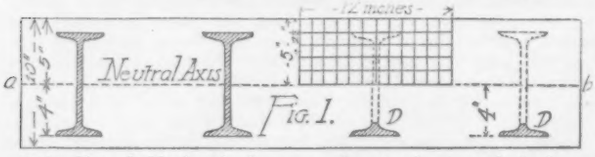


Fig. 1.

web itself to hold the tie in connection to the top of the beam, whether such web is concrete or metal, is due to the difference of the thickness necessary for this purpose.

Where the web is of concrete instead of metal, being proportionate to the difference between the cohesive strength or power of metal and concrete.

It is important to make use of ties having the greatest friction surface for side adhesion, hence flat, thin ties with projections are preferable; but the invention comprises other shapes where the surface is roughened, or may be crimped, corrugated, indented, or with pins, bosses, or projections of any kind.

There is not that tendency to buckle or lateral inclination when under strain with a concrete beam as in that of an iron one, due to the thickness of the web.

The arrangement of the blades or ties as shown in the gridiron, from Plate 22, and others being the most effective and simple.

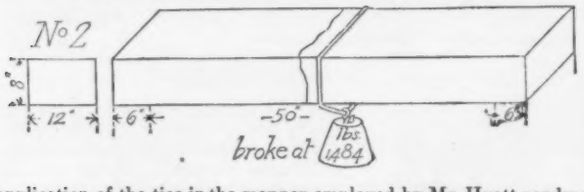
The application of the ties to the concrete body. In the application of these ties to a Portland cement concrete body what action are the different parts subjected to when employed? The upper portion of a concrete body resists compression of which Portland cement is known to possess this property to a great degree compared to its property to resist separation. General Gilmore says, the proportion at the age of nine months is fourteen of resistance to compression, to one of resistance to extension, while cast-iron is but six-and-one-half to one of tension.

In General Gillmore's work, entitled "*Coignet Beton and other Artificial Stones*," on page 34, is as follows: —

The strength of English Portland cement to resist compression from trials made of a block nine months old was 5,973 pounds per square inch; with one volume of sand, same age, 4,568 pounds per square inch, and on pages 53 and 54 is as follows: —

It is known that the strength of Portland cement mortars does not reach its maximum limit within a period of two, or perhaps three years.

Neat cement in blocks of the size of an ordinary brick, at the age of nine months, the compressive to its tensile strength becomes in the ratio of fourteen to one. With a mixture of one of cement and two of sand, the ratio will be found between the limits of fourteen to one and nineteen to one. This exhibits the tensile weakness of Portland cement, compared to its great resistance to crushing, and by the



application of the ties in the manner employed by Mr. Hyatt renders the feeble part equal to its strong compressive property.

When a beam or slab of this, or any other material of like nature, is loaded on its top surface, the upper part being in compression, is greatest at the top surface, and diminishes gradually until it ceases about midway of its depth, or wherever the neutral axis may be; and from there extension or tendency to separate the parts begins in the least, and increases gradually until the bottom surface is reached, which is the greatest.

These iron ties with projections close together, or roughened surfaces, extend the length of the tie, and for holding to the cement and side adhesion to the body of the tie, are placed as near to the bottom of the cement or concrete body as practicable, so as to be firmly held there.

It is intended to have that part of the concrete body to resist compression fully up to, and may be in excess of, the tensile strength of the iron ties, as the formulated calculation is based on the tensile strength of the ties.

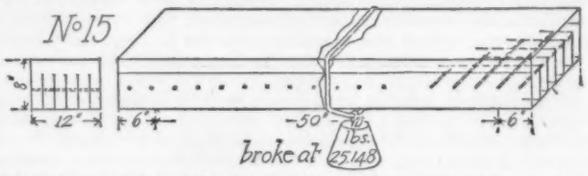
We have by this combination a cheap and simple method of utilizing the strength of a Portland cement concrete body, compressively considered, without its weak tensile resistance entering into the calculation.

The formula for computing its strength, providing the ties are kept at a proper distance below the neutral axis, is as that for computing the strength of a make-up wrought-iron beam or girder; that is, after the top and bottom sections, each way from the neutral axis, are adjusted in their respective resistances.

Mr. Hyatt's disquisition on the results of his experiments with this construction is set forth, entitled "*An Account of Experiments with Portland Cement Concrete combined with Iron as a Building Material*," of which the following is an extract:

Figure 1 represents a section of a Portland cement concrete floor, with rolled wrought-iron beams built in it. When employed, what function do the several parts perform? The top surface resists the greatest compressive force, which gradually diminishes downward until the neutral axis, *a*, *b*, is reached, where it ceases to exist. From there commences the minimum of tensile strain, which increases until the bottom surface is reached, which is the maximum of the tensile strain. Referring to Figure 1, what sustaining function does the concrete flooring with the integral parts thereof perform? The parts of iron beams above the neutral axis, *a*, *b*, are worthless, and a consequent useless expense, as their resistance at that place to compression is not brought into action; the Portland cement concrete unassisted, as will be shown, has a greater power of that resistance than the case requires. To the right, in Figure 1, the part laid off in square inches from the neutral axis *a b* to the top surface is five inches, and a width of twelve inches, making an area of sixty inches.

If we take the compressive resistance of Portland cement concrete at 2,000 pounds per square inch (in General Gilmore's experiment nine months old one of cement, and two of sand crushed at 3,631 pounds per square inch), we get a mean of 1,000 pounds acting two-and-a-half inches, or half-way between the neutral axis and top surface; therefore we have sixty square inches of 1,000 compressive pounds to the inch, equalling 60,000 pounds acting on the end of a lever, two-and-a-half inches from the fulcrum, the neutral axis, *a b*,



$60 \times 2\frac{1}{2} \times 1{,}000 = 150{,}000$ pounds to resist compression, and to balance tension below the neutral axis.

This is without that part of the iron beam above the neutral axis doing any duty.

Then if we take the metal *D* (the bottom flange of the beam only, the shaded part) held in the concrete in the manner described, at two inches wide, and one-quarter of an inch thick, equal $2 \times \frac{1}{4} = \frac{1}{2}$ inch of iron, and assuming the tensile resistance of wrought-iron at twenty-five gross tons, or 56,000 pounds per square inch, then the half-inch tie represents 28,000 pounds, multiplied by the leverage of four inches down from the neutral axis, which is the fulcrum to both, we have 28,000 pounds multiplied by four inches leverage equals 112,000 pounds.

The compressive surface of the concrete, 150,000 pounds, is therefore in excess of the demands of the tie metal, and the top flange and web of the iron beam are useless, and only the bottom flange is employed. Therefore, three-quarters of the beam is of no avail.

Many have questioned the possibility of uniting metal to concrete as a bottom flange is held to its web in a rolled or riveted beam, and as to whether when under strain the two materials will act in concert.

The answers to these queries is by reference to Nos. 15, 16, 17, 18, and 19, as being five examples in thirty-one experiments. Several trials were made without projections on the ties, which in every case pulled through the concrete.

A study of them shows from the breaking of the metal: Firstly, that all the blades of the iron were perfectly held in the concrete body, while the beam was under strain. Secondly, that in both cases the two materials worked in perfect harmony. Thirdly, that the proportionate power of the metal increased regularly as it became tie metal.

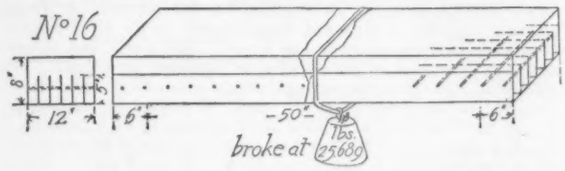
The 2 × 1-16-inch blades of beam, No. 19, exhibited a greater tensile power in proportion to cross section than No. 16, where the blades were five inches in depth; the higher the blades, the more they lose as a tie, as the strain proportionately diminishes the nearer the tie metal is to the neutral axis. Therefore, the ties in all cases must be a proportionate distance below the neutral axis.

When a beam of any kind is subjected to a bending stress, it becomes more or less curved, by virtue of which the lower portion is lengthened, and the upper portion shortened, in proportion to the

depth of the beam or the difference of length between the radii of the curves.

Were the beams made up of horizontal layers the effect of the stress would be to cause these to slide one upon another, but the beam being solid the particles are held together by their own cohesion, the shearing strains being thus opposed by cohesive force.

The primary strains in the beam or the lines of compression and extension being upon curved lines the disturbed particles must of necessity tend to arrange themselves in harmony with the radial lines of circles, all below the neutral axis seeking extension, and all above compression. How slight are the *duties* of the *web* of a *beam*



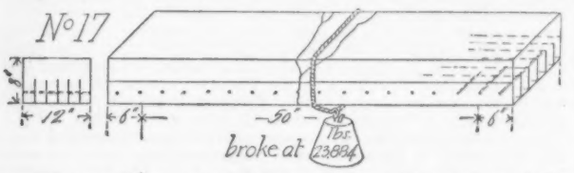
under these circumstances may be seen from the exceeding thinness to which it is possible to reduce it, which fact seems to confirm the view that the web of a beam possesses cohesive power sufficient to resist the shearing strains resulting from a bending stress; it is equal to all the duties required of it, all other strains upon it being secondary and inferior.

It is not difficult to understand how a metal tie is held in the embrace of a concrete web, nor how a web of concrete four or five times as thick as metal webs are usually made, should be quite able to perform its part and become equally serviceable.

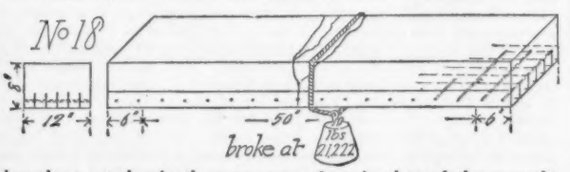
A flat tie, as is exhibited in Figures 26, 28 and 30, plate *J* (omitted) on account of the large holding surface presented for the concrete as on that of the bottom flange of the rolled beam dwelt on in the fore part of this, in Figure 1, is probably the best form in which iron can be used.

When placed edgewise, as in Figures 15, 16, 17, 18 and 19, and the illuminating-tile, it seems to be the most convenient tile that can be employed; the wires that connect the bars, called the gridiron tie, serve as stops to prevent the metal sliding when the beam is under strain. This evidences that the tie becomes attached to the web practically throughout its entire length, and as firmly at one point as at another.

The formula for computing the strength of this Portland cement



concrete beam, providing the ties are at a sufficient distance below the neutral axis, should be as in that for computing the strength of a wrought-iron plate girder. With the latter we first proportion the top and bottom flanges in metal quantities, correspondingly to their resisting power to compression and extension. Wrought-iron being about thirty-five per cent the weaker in resisting compression, than much more metal must be in the compressive member than in the tensile one. After proportioning the beam, no more attention is given to the part subject to compression, but only to ascertain the section of the bottom flange subject to extension, and the depth of the beam; and as our tensile member in the Portland cement concrete combined with iron is of wrought-iron, and is held to the web and exercised in the same way as in that of the plate-girder, and all other parts are in the same relationship, the constant must be the same. Therefore, after the concrete beam is proportioned to have sufficient concrete material for compressive strength to balance the tensile capacity of the ties held in place, and at a sufficient distance



below the neutral axis, then we proceed as in that of the wrought-iron girder after the parts of it are balanced in their respective resistances.

First, for a numerator multiply the sectional area of the iron tie-bars, deducting for holes, by the depth to be from the centre of the tie-bars to the top of the beam, and multiply the product by the constant of 80, as in the formula of the wrought-iron girder.

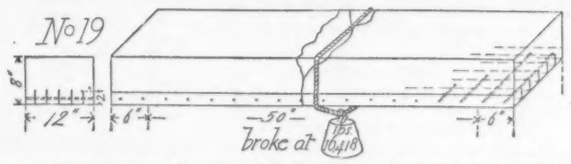
For the denominator take the number of inches between the supports; the quotient will be the breaking load in tons in the centre of the beams. All parts performing their respective duties is equally applicable in this composite construction as in that of the wrought-iron girder.

It is the basis in supporting power serviceable in so many applications in buildings and other constructions, as supporting walls for floors, slabs, sidewalks, beams, girders, etc.

No. 2 was a beam of concrete without iron, and broke at 1,484 pounds, and, taken as a unit in contrast with the following, that were tensilely strengthened by iron ties, as shown in Nos. 15, 16, 17, 18 and 19.

No. 19 had 21 pounds of iron, which increased its strength eleven and one-half times of the plain concrete beam (No. 2 and computed by the formula given) broke at one per cent in excess of formula.

These tie-bars were kept at a proper distance below the neutral



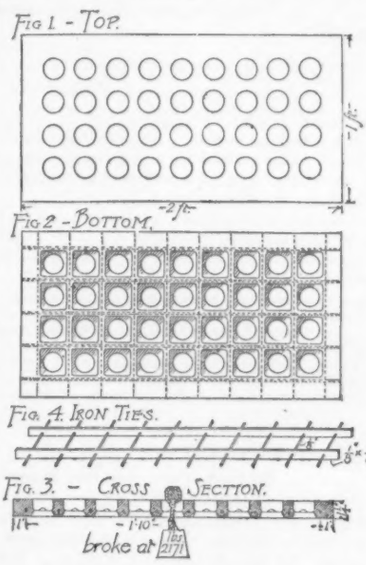
axis, which was not the case with the others; had the tie-bars been a greater distance below the neutral axis, undoubtedly better proportionate results would be attained.

No. 15 had 62 pounds of iron, which increased its strength seventeen times.
No. 16 had 52 pounds of iron, which increased its strength seventeen and four-tenths times.
No. 17 had 41 pounds of iron, which increased its strength sixteen times.
No. 18 had 31 pounds of iron, which increased its strength fourteen and three-tenths times.
No. 19 had 21 pounds of iron, which increased its strength eleven and one-half times.
No. 26 had 31 pounds of iron (flat ties), which increased its strength.
No. 28 had 23 pounds of iron (flat ties), which increased its strength.
No. 30 had 40 pounds of iron (flat ties), which increased its strength.

With these three latter, being four inches greater in depth, could not compare results with No. 2.

In all cases the iron ties broke and were firmly held in the concrete body in the manner that a bottomless flange of an iron beam is held to its web.

In San Francisco, November 3, 1883, at No. 231 First Street, a Portland cement illuminating tile, combined with iron ties, as here shown, was tested, but being only twenty days old, was not old enough for great strength, but was still in excess, at that green age, of the heaviest cast-iron illuminating-tile, three-fourths of an inch thick and tested centrally in the same way, which broke at 2,105 pounds, while the new cement tile broke at 2,171 lbs. Both of these tests were witnessed by J. Haustein, James B. Lane, and L. Girolt.



On November 28, 1883, at the same place, a trial was made of the same size Portland cement illuminating-tile about forty days old, as shown, and the fractured tile presented, of which Figure 1 is the top, and Figure 2 the bottom, Figure 3 is a cross-section, and Figure 4 shows the iron ties, five in number, one-eighth by five-eighths of an inch flat iron, threaded on ten 3-32 of an inch steel wires, — subsequently 3-16 of an inch iron wires were used — total weight of iron and steel three and one-quarter pounds, tested by an octagon steel bar of one inch in diameter, presenting a half-inch surface bearing centrally across the tile.

At 1376	pounds	deflection	noted,	5-32 inch.
" 1545	"	"	"	7-64 "
" 1717	"	"	"	1-8 "
" 1906	"	"	"	5-32 "
" 2017	"	"	"	3-16 "
" 2150	"	"	"	13-64 "
" 2300	"	"	"	1-4 "
" 2405	"	"	"	9-32 "
" 2600	"	"	"	3-8 "
" 2710	"	"	"	29-64 "
" 2750	"	broke.		

Witnessed by Mr. John Wright, Mr. G. W. Percy, and Mr. W. P. Moore, architects, of San Francisco.

The Portland cement, combined with iron illuminating-tile one and one-fourth inches thick, bore 635 pounds more than the heaviest cast-iron illuminating-tile used over areas three-fourths of an inch thick, both tested in the same manner.

A trial was made at the Industrial Iron Works, on Beale Street, San Francisco, January 19, 1884, of a Portland cement concrete slab, with iron, such as will be used for sidewalks and floors,

dispensing with supporting arches. It was 3 inches in thickness, and 4 feet 6 inches square = 20 feet 3 inches, resting on two end supports, each 3 inches, leaving the distance between supports 4 feet, and by 4 feet 6 inches = area 18 feet.

The ties consisted of nineteen 1-inch wide by one-eighth inch thick bars, placed 2¾ inch centres, and threaded on nine ¼-inch diameter iron rods, placed 6 inches centres; total weight of iron, 41 pounds.

The top of the flat bars were 1⅝ inches below the top of slab. Age of slab, 62 days.

This was tested in the presence of Mr. G. W. Percy and Mr. John Wright, architects, as follows, loaded with: —

18,234	pounds	pig-iron	deflected	9-32	of	1	inch, or	900 pounds per foot.
21,111	"	"	"	5-16	"	"	1,042	" "
24,140	"	"	"	3-8	"	"	1,192	" "
26,885	"	"	"	7-16	"	"	1,328	" "
29,544	"	"	"	1-2	"	"	1,459	" "
32,747	"	"	"	9-16	"	"	1,617	" "
35,006	"	"	"	5-8	"	"	1,725	" "

36,375 broke at 1,797 pounds per foot.

At 32,747 pounds, or 1,617 pounds per foot, and nine-sixteenths deflection, a small crack was first observed.

The question was asked as to the stability of this construction to resist impact.

The speaker said that when the deflection caused by force of impact was within a certain safe limit of the elastic force of the material, it is equally as serviceable as in other substantial constructions. In the computation as to the safe bearing load of any construction, the most severe service it may be subjected to must be considered, so that the strain in such service is within a certain recuperative force of the material. With cast-iron beams it is safe to employ them at rest at one-third the breaking load. In this construction for sidewalks and floors, etc., I take it that one-fourth of the breaking weight will be a safe employed load.

For fire-proof walls and other surfaces and purposes, Mr. Hyatt has found that mixing a small percentage of sulphur with a body of Portland cement, and then heated to a red heat, will stand the effects of cold water when thrown upon it.

I have made the trial with this composition, made in brick form, and, when heated red hot and thrown into a pail of cold water, it retained its form nearly equal to fire-brick; while a body of neat cement of the same form and age, and by the same treatment, partially dissolved like sugar when placed in the water. Mr. Hyatt has secured these combinations by two United States patents, of which Mr. Jackson has the right for this coast.

HOW TO STUDY ARCHITECTURE.

Springfield, Mass., September 22, 1884.

To the Editors of the American Architect: —

Dear Sirs,—I want to ask you what method I should pursue in the study of architecture. I am a young man of 20, and have decided on this as my life-work. I know that I am in every way fitted for it, and was so told by Nelson Sizer, the Phrenologist.

I suppose the first necessity is a knowledge of mechanical drawing. Are there any text-books written for students of this science? If you will please give me your advice, with a course of study, you will greatly oblige Yours very respectfully, E. C. Plummer.

[The profession of architecture involves a good many things besides mechanical drawing. Much the best and most economical way to fit one's self for such a career is to enter a good technical college where architecture is taught, and pursue the course faithfully. By such systematic study, under judicious masters, more real advance will be made in a year, than in three years of self-instruction, which, although it indicates a creditable energy on the part of the pupil, is a tedious and wasteful mode of learning anything. — Eds. American Architect.]

SOLID IRON COLUMNS.

St. Paul, Minn., September 20, 1884.

To the Editors of the American Architect: —

Dear Sirs, — I have often heard parties say that a solid cast-iron column is not as strong as a hollow cast-iron column of same diameter, by parties who should know. As this is contrary to what I have always understood, I would ask you to give your valued opinion in the next number of the paper. A Reader.

[A solid column of iron is stronger than a hollow one of the same diameter. The same weight of metal, however, will give more strength in a hollow than a solid column, and this is probably what the persons referred to intended to say. — Eds. American Architect.]

THE POSITIVE BLUE PROCESS.

St. Louis, Mo., September 22, 1884.

To the Editors of the American Architect: —

Dear Sirs, — The formula given in your last issue for *blue lines on white ground* proved unsatisfactory when I used it; the preparation was made under direction of a chemist; could it be that there is some omission in the formula? I get a blue ground with a darker blue line after the baths on exposure. I cannot get the *orange* ground mentioned, though the image is as you say, a light canary.

If you could give me any further advice, I would be grateful; perhaps you could forward this to the author of the article you published. I am thoroughly familiar with the *negative* process.

Very truly yours, Kivas Tully.

[We cannot from personal knowledge explain the cause of our correspondents failure; but trust that some other reader may be able and willing to help him.—Eds. American Architect.]

A PLUMBER ON PROTECTION.

Wilmington, Del., September 22, 1884.

To the Editors of the American Architect: —

Dear Sirs, — The *Sanitary Engineer* of the 18th inst., under the head of the Plumbers' and Dealers' Trade Protection Controversy claims "that the *American Architect* greatly overrates the power and influence of the men claiming to speak for the Plumbers of the United States." We take issue with the controllers of this journal on this subject, and speak the sentiment of the leading plumbers in this section of the country in believing that the *American Architect* is viewing this matter in its proper light. It is alleged that the editors or controllers of the *Sanitary Engineer* are interested in the manufacture and sale of plumbers' supplies, and hence their judgment must necessarily be more or less biased. Architects and plumbers alike are interested in protecting their customers or clients. What protection has the consumer against extortionate prices, when an architect specifies any particular make of goods? for example, the Meyer, Sniffen Co.'s, to be used in the plumbing of a building, the plumber is compelled to buy this make of goods at whatever price the Meyer, Sniffen Co. place upon them. If the *Sanitary Engineer* was edited, owned, and controlled by parties having no interest in the manufacture or sale of plumbers' materials, then it might reasonably claim to speak as independently as the *American Architect*.

Justice.

NOTES AND CLIPPINGS.

The Hardening of Cements. — Herr Frühling, in a communication to one of the German technical societies, says the *Mechanical World*, makes some important comparisons between the rate of hardening of hydraulic cements, and upon the nature of this process. According to this investigator, a Portland cement, (which requires from twelve to fifteen hours to set) will, inside of three days, have acquired a greater hardness than the far more quick-setting Roman cement (which requires only from five to fifteen minutes to set). He makes the further assertion that, while the hardening process with the quick-setting Roman cement continues for many months, or even years, this process with a genuine Portland is substantially completed within the first fifteen days; for the amount of increase in hardness which takes place thereafter, he affirms, is quite insignificant in comparison with the figures representing the hardening of the first fifteen days. In this statement Frühling is not in accord with all writers on the subject, who are unanimous on the point that Portland cement continues to gain notably in hardness and tenacity for the period of a year, or even considerably longer. He discards also the generally accepted explanation that the hardening of cements depend on the formation of silicates. He considers a hardened cement to possess, both chemically and physically, the properties of a dense hydrate of lime. He bases these statements on the following facts: The natural hydrated silicates of lime do not exercise any decomposing action on solutions of ammonium salts — the chloride, or sulphate for example — while, as a rule, the entire quality of lime in a cement, whether it be derived from a Portland or a Roman cement, will act upon the above-named ammonium salts, precisely like hydrated lime, to decompose them. He argues that in the production of a cement the rule should be followed not to endeavor to introduce the largest possible quantity of silicic acid, but the largest possible quantity of lime. If the proper limit is overstepped, so that, for instance, three or four per cent more silicic acid is introduced than experience has shown to be sufficient, the result is not a better hardening cement, but, on the contrary, one that is almost worthless. The formation of a hydrate of lime, according to Frühling, is the basis of a binding quality of the cements; and, in comparison with lime, he claims that silicic acid and alumina play a very subordinate *rôle*.

Irrigation Works in Italy. — The irrigation system of Italy is probably the most complete in the world, and still it is constantly being increased; it forms a part of the elaborate system of defence against floods necessitated by the conformation of the Northern Provinces. According to the latest official statistics, the irrigation canals of Piedmont alone give 125,550 gallons per second, distributed over 1,340,000 acres, and those of Lombardy 95,355 gallons per second, distributed over 1,680,400 acres. These great works have not been, comparatively speaking expensive. The Cavour canal, constructed within the last few years, draws its supply from the rivers Po and Dora Baltea. It gives a flow of 29,200 gallons per second, waters nearly 40,000 acres, and cost 1,600,000*l.*, about 32,200*l.* per mile. It was constructed in four years, and measures are now under consideration for increasing its debit by 5300 gallons per second, A smaller canal, subsidiary to it, gives 18,540 gallons per second, and cost 24,154*l.* per mile. The largest canals are the Cavour, and its subsidiary canal just mentioned; the Muzza, and Agliano and Naviglio Grande. The smaller of these gives 13,200 gals. per second. Below this point the canals become very numerous, and interspersed all over the country. These canals are not only used for purposes of irrigation, but also to supply motive power, by which again the water is raised to districts lying upon a higher level. On the steep slope of the Dora Baltea, not far from Turin, three canals (the Torea, Agliano and Rotho) flow parallel to each other, on different levels, while the water is used at the top of the hill, 62 feet above the highest of them. The arrangement adopted is as follows: A stream of 154 gallons per second is diverted from the Torea canal, and carried down the hill in a leaden pipe, until it meets the Agliano Canal. Here it is pumped up to the summit level by eight pumps, worked by four turbines, driven by a fall of water taken from the Agliano canal, and allowed to flow down into the Rotho. By joining this latter it is used for irrigation, and thus not a drop is wasted. The great principle of Italian engineers is to work on a large scale, thus attaining at the same time efficiency and economy, avoiding constant alterations and additions; and it is by such means that the extraordinary fertility of Northern Italy is produced and maintained.

BUILDING INTELLIGENCE.

(Reported for The American Architect and Building News.)

[Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.]

BUILDING PATENTS.

[Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.]

305,419. HATCHWAY-ELEVATOR. — John William Birely, Frederick, Md.

305,426. DOOR-KNOB ATTACHMENT. — John K. Clark, Buffalo, N. Y.

305,428. RECLINING FOLDING BACK FOR SEATS. — Lewis B. Covert, Elgin, Ill.

305,429. BACKING FOR VENEERS. — Leonard H. Cremers, Pullman, Ill.

305,443. OPENER AND FASTENER FOR DOORS.—Augustus M. Freeman, Ocean Grove, N. J.

305,455. CURTAIN-FIXTURE.—Daniel E. Kempster, Boston, Mass.

305,457. SMOKE AND GAS CONSUMING FURNACE. — Mathias Krudewig, Frankfort-on-the-Main, Germany.

305,461. FURNACE.—Lewis Metesser, Indianapolis, Ind.

305,471. WEATHER-STRIP. — Emmeline W. Philbrook, Boston, Mass.

305,480. WATER-GRATE FOR FURNACES.— Richard P. Shackelford, Jerseyville, Ill.

305,485. MACHINE FOR SHAPING SASH-RAILS. — Geo. W. Steele, Paterson, N. J.

305,489. WINDOW.—William C. Tucker, Alden, N.Y.

305,500. WINDOW-BEAD FASTENER. — William H. H. Barton, Brockton, Mass.

305,516. STEP-LADDER. — Nathan Fisher, Coatesville, Ind.

305,542-543. ELEVATOR. — William Stevens, Philadelphia, Pa.

305,549. HINGE FOR AWNING-BLINDS. — Henry S. Tucker, Faulkner, Mass.

305,558. MANUFACTURE OF DOOR-KNOBS.— Williston L. Alvord, Bridgeport, Conn.

305,559. DOOR-KNOB.—Williston L. Alvord, Bridgeport, Conn.

305,571. FENCE-POST.—James W. Cheney, Detroit, Mich.

305,574. FILTER.—James A. Crocker, Boston, Mass.

305,582. FIRE-ESCAPE.—Jane Finnegan, Litchfield, Ill.

305,584. PORTABLE HOUSE.—Lorenzo Forrest, Minneapolis, Minn.

305,589. GRATE-BAR. — August Haarlander, Allegheny, Pa.

305,650. FURNACE. — Thos. C. Zetzsche, Okawville, Ill.

305,681. SHUTTER-FASTENER.—Cuningham Drake, Philadelphia, Pa.

305,682. FENCE.—Joseph Du Bois, Waverly, N. Y.

305,683. WEATHER-STRIP. — Daniel Seth Early, Harrisburg, Pa.

305,684. LOCK.—Alvan B. Ewing, Lewisburg, Tenn.

305,687. AUTOMATIC SASH-HANGER. — Winfield S. Greening, Decatur, Ill.

305,688. ELECTRIC FIRE-ALARM AND CALL-BELL SYSTEM.—P. Gugerty, Waterford, N. Y.

305,689. SAFETY DEVICE FOR ELEVATORS.— Lewis W. Hewett, Sumner J. Leonard, and Philip B. Shaw, Williamsport, Pa.

305,691. HEATING STOVE AND FURNACE.—Michael T. Hines, South Boston, Mass.

305,693. WINDOW-CURTAIN FIXTURE.—Charles E. Kemp, Baltimore, Md.

305,713. HEAT CONDUCTOR AND RADIATOR.— Matthew Ryan, Washington, D. C.

305,716. MANUFACTURE OF PLATE-GLASS. — Herman Schulze-Berge, Rochester, Pa.

305,720. GLASSWARE.—August Sperber, Wellsburg, W. Va.

305,726. ELECTRIC DEVICE FOR LIGHTING GAS. — Horatio N. Williams, Providence, R. I.

305,728. BRICK-MACHINE. — Charles A. Wyman, Hutchinson, Minn.

SUMMARY OF THE WEEK.

Baltimore.

STORE AND DWELLING. — Louis J. Ginter, architect, has prepared plans for a store and dwell. for Andrew Wirth, Esq., to be erected on the n w cor. Pennsylvania Ave. and Pitcher St., to cost $3,500; Edward A. Smith, builder.

DWELLING-HOUSES. — Plans have been prepared for a handsome row of square dwells., to be erected on Lafayette Ave., near Lafayette Square, 16′ x 44′ each, to cost about $3,000 apiece, for Wm. Collett, Esq.; Louis J. Ginter, architect.

BUILDING PERMITS. — Since our last report fifteen permits have been granted, the more important of which are the following: —

M. A. Caldwell, 2 two-st'y brick buildings, e s Wilcox St., s of Chase St.

B. Fallon & J. Ward, 2 three-st'y brick buildings, s s Chase St., e of McKim St.

Martin Schuler, three-st'y brick building, s s Columbia Ave., between Sterrett and Scott Sts.

Maria L. Small, 2 two-st'y brick buildings, s s Elbow Lane, between Greene and Warner Sts.

C. L. & J. S. Clark, 8 two-st'y brick buildings, commencing s e cor. Chase and Wilcox Sts., fronting on s s Chase St.

The labor quotations for October remain unchanged.

Boston.

BUILDING PERMITS. — *East Fifth St., Nos.* 704 *and* 706, Ward 14, for H. B. Stratton, 2 brick dwells., 22′ x 50′, flat; H. B. Stratton, builder.

Brooklyn.

BUILDING PERMITS.—*Spencer St.*, w s, abt. 350′ s Myrtle Ave., three-st'y frame (brick filled) tenement, tin roof; cost, $4,600; owner and architect, Henry Schwartz, 671 Quincy St.; builders, Caspar Wahlen and John Rueger.

Lynch St., n s, abt. 240′ e Lee Ave., 2 three-st'y frame (brick filled) tenements, gravel roofs; cost, each, $2,000; owner, John Jeffers, 152 Marcy Ave.; architect, C. Wells.

Stockton St., n s, 100′ w Lewis Ave., 8 three-st'y frame (brick filled) tenements, tin roofs; cost, each, $4,500; owner, T. J. Moore, 72 Sumner Ave.; architect and builder, John Erickson.

North Eighth St., s s, 315′ w First St., two-st'y brick storage, gravel roof; cost, $12,000; owners, Dick & Meyer; builder, James Rodwell.

Hancock St., s s, 225′ e Reid Ave., two-st'y brick dwell., tin roof; cost, $3,800; owner, Emma Naul, 853 Herkimer St.; architect, Amzi Hill; builders, F. H. Stout & Bro.

Stockton St., No. 316, s s, 228′ 6″ e Sumner Ave., three-st'y frame tenement, tin roof; cost, $4,000; owner, Mr. Proestler, on premises; architect, Th. Engellardt; builders, Ulrich Maurer and D. Kreuder.

Ninth St., s w cor. Fourth Ave., 5 three-st'y brick flats, tin roofs; cost for all, $35,000; owners and builders, Assip & Buckley, 77 Waverly Ave.; architect, M. Goats.

First St., e s, 100′ s Grand St., 2 five-st'y brick stores and tenements, tin roofs; cost, each, $7,500; owner, D. Allers, cor. Sixth St. and Broadway; architect, E. F. Gaylor; mason, Thomas Gibbons.

Fulton St., s e cor. Howard Ave., 2 three-st'y brown-stone stores and flats, gravel roofs; cost, $7,250 and $8,000; owner and architect, Benj. T. Robbins, Northport, L. I.; builders, E. K. Robbins and John Remsen.

Quincy St., n s, 330′ e Reid Ave., 4 two-st'y brown-stone dwells., tin roofs; cost, each, $4,500; owner, A. Stewart Walsh, Madison St.; architect and builder, A. Miller.

Decatur St., n s, 90′ s Lewis Ave., 6 three-st'y brown-stone dwells., felt and gravel roofs; cost, each, $5,000; owner and architect, John C. Bushfield, 675 Herkimer St.

Hancock St., Nos. 202 *and* 204, s s, 250′ w Marcy Ave., 2 three-st'y brick dwells., tin roofs; cost, each, $12,000; owner and builder, Geo. H. Stone, 301 Jefferson St.; architect, G. A. Schellenger.

Jefferson St., Nos. 309, 311, *and* 313, n s, 310′ e Marcy Ave., 3 three-st'y brown-stone dwells., tin roofs, wooden cornices; cost, each; $11,000; owner, etc., Geo. H. Stone, 301 Jefferson St.

Clifton Pl., s s, 100′ e Classon Ave., two-st'y brick stable and dwell., tin roof; cost, $6,000; owner, A. J. Pouch, 315 Greene Ave.; architects, Eastman & Daur; builders, P. J. Carlin and Long & Barnes.

Schenectady Ave., n w cor. Pacific St., two-st'y brick factory, tin roof, brick cornice; cost, $10,000; owner, James Winship, Buffalo, N. Y.; architect, Phineas M. Smith; builders, A. A. Fardon and Phineas M. Smith.

Clinton Ave., e s, 27′ s Lafayette Ave., three-st'y and mansard brown-stone dwell., slate and tin roof; cost, $100,000; owner, Robert Graves, Fulton St., near Carlton Ave.; architect, W. A. Mundell; builder, Cornelius Cameron.

Herkimer St., s s, 200′ e New York Ave., 3 two-st'y brick dwells., gravel roofs; cost, each, $2,000; owner, E. R. Betts, Pacific St.; architect and builder, D. H. Fowler.

ALTERATIONS.—*Court St.*, s w cor. Harrison St., mansard roof removed, and front wall carried up with stone and brick, roof to be raised, etc.; cost, $3,000; owner, Samuel E. Shaw; architect, Henry J. Dudley, 1300 Broadway, New York city.

Chicago.

BUILDING PERMITS. — A. K. Blair, three-st'y flats, 292 and 294 Illinois St.; cost, $8,000.

Russel Bros., two-st'y flats, 717 to 721 Wells St; cost, $17,000; architect, G. L. Halberg.

W. Schmidt, four-st'y store and dwell., 75 and 77 Clybourne Ave.; cost, $15,000.

F. W. Luebs, two-st'y dwell., 12 Fry St.; cost, $6,000.

W. Sprunck, two-st'y store and dwell., 217 Clybourne Ave.; cost, $6,000; architect, F. Berlin; builder, F. Nehls.

Williams & Carson, 2 two-st'y dwells., 278-282 Idaho St.; cost, $7,000; architect, A. Williams.

A. Johnson, three-st'y dwell., 247 Polk St.; cost, $8,000; architect, A. Smith; builder, N. Cameron.

C. Schlecht, two-st'y dwell., 577 South Morgan St.; cost, $4,000; architect, F. W. Ruehl.

F. A. Ruck, three-st'y stores and flats, 273 Wells St.; cost, $8,500; architects, Bauer & Hill; builder, C. Hellmann.

A. C. Young, three-st'y store and dwell., 3036 Wabash Ave.; cost, $12,000; architect, L. D. Cleaveland; builder, Wm. Barton.

M. Brand & Co., two-st'y store and dwell., Noble and Augusta Sts.; cost, $7,000.

G. H. Wheeler, two-st'y barn, 1812 Prairie Ave.; cost, $4,000; architects, Burnham & Root.

C. Weilder, two-st'y store and dwell., 111 Fulton St.; cost, $4,000; architect, Schnoor.

E. B. Baker, two-st'y dwell., 868 Fulton St.; cost, $5,000; architect, Longhurst.

J. Pepper, three-st'y store and dwell., 406 Ogden Ave.; cost, $4,300; architect, H. Copeland; builder, McKay.

H. Thurston, two-st'y dwells., 22 and 24 Will St.; cost, $4,600; architect, H. Copeland; builder, McKay.

John Popp, two-st'y dwell., 101-105 Twenty-fifth Pl.; cost, $3,000.

J. M. Beers, addition, 785 Elston Pl.; cost, $3,000.

Mrs. Erlandson, three-st'y dwell., 50 West Ohio St.; cost, $2,500.

J. A. Anderson, two-st'y flats 458 West Huron St.; cost, $4,000.

A. J. Snell, 11 three-st'y dwells., 1 to 15 Elizabeth St.; cost, $45,000; architect, A. Smith; builder, F. Hansen.

P. H. McElroy, two additional stories, 528 Indiana St.; cost, $5,000; architect, W. H. Drake; builder, J. Connell.

F. Seelow, two-st'y dwell., 663 Twenty-second St.; cost, $3,600; builders, Rossman & Roeder.

D. Cahn, three-st'y store and dwell., 114 Chicago Ave.; cost, $7,500; architect, T. V. Wadskier.

Geo. Rupp, three-st'y dwell., 2929 State St.; cost, $4,000; architect and builder, Geo. Rupp.

J. Theurer, two-st'y dwell., 1809 Indiana Ave.; cost, $16,000; architect, E. Baumann.

G. Voldt, two-st'y dwell., 505 Marshfield Ave.; cost, $4,300; builder, C. Geger.

Cella & Malatesta, 2 three-st'y stores and dwells., 3812 and 3814 State St.; cost, $9,000.

Remodelling livery-stable for J. J. Brown, West Madison St.; cost, $8,000; C. H. Haskell, architect.

Flats on Monroe St.; cost, $7,500; John Anderson, owner; C. H. Haskell, architect.

Cincinnati.

BUILDING PERMITS. — W. C. Wehrman, two-and-one-half-st'y brick building, e s of Loth St., near Mulberry St.; cost, $3,400.

G. Strotmann, three-st'y brick building, 76 Coleman St.; cost, $4,500.

J. T. Siever, three-st'y brick building, 61 Liberty St.; cost, $5,600.

Mrs. E. Bredniger, 3 two-st'y brick buildings, n s of Poplar St., n of Linn St.; cost, $5,500.

Mrs. J. J. Wright, three-st'y brick building, 40 Mason St.; cost, $2,800.

A. Walton, four-st'y brick building, 330 West Sixth St.; cost, $5,000.

Minneapolis, Minn.

BUILDING PERMITS. — J. H. Davenport, two-st'y wooden dwell., Vine Pl.; cost, $6,500.

City of Minneapolis, two-st'y brick engine-house, n s Twelfth Ave., between Washington Ave. and Third St., north; cost, $9,540.

Chas. J. Martin, executor, one-st'y brick boiler-house, s w cor. Seventh Ave. and Canal St., south; cost, $6,000.

A. H. Edsten, two-st'y brick store and flats, w s Cedar Ave., between Fourth and Fifth Sts., south; cost, $5,000.

James McMullen, alteration to two-st'y dwell., n e cor. Fourth St., between Sixth and Seventh Aves., s e; cost, $3,800.

F. T. Dinsmore, two-st'y wooden dwell., cor. Third Ave. and Lake St., s; cost, $3,000.

St. Paul & Northern Pacific R. R. Co., brick round-house; cost, $30,000.

John Kelley, two-st'y store and flat; cost, $3,000.

Mrs. Robert Anderson, two-st'y building; cost, $4,500.

St. Paul & Northern Pacific R. R. Co., brick freight-house; cost, $50,000.

St. Paul & Northern Pacific R. R. Co., three-st'y brick freight-office; cost, $5,000.

J. H. Thompson, two-and-one-half-st'y double tenement, brick veneer, e s Highland Ave., near Royalston; cost, $8,000.

Roman Catholic church, three-st'y stone parish school-building, w s Second St., between Eighth and Ninth Aves., n e; cost, $10,000.

New York.

CHURCH.—On the 28th of September, the corner-stone of the Church of our Lady of Mt. Carmel was laid by Archbishop Corrigan. The building is being erected under the superintendence of the rector the Rev. Dr. Kirner; from plans of Mr. L. J. O'Connor.

FACTORY. — A silk factory 50′ x 125′, and 2 five-st'y brick tenements, 25′ x 82′ each, are to be built for Mr. Jacob New on the s s of Fifty-fifth St., e of Eleventh Ave.; from plans of Mr. J. H. Valentine.

STRIKES.—The continuance of the building strikes has virtually stopped new work; several plans have been drawn for work which will go on, should matters with the men be satisfactorily settled.

BUILDING PERMITS. — *West Fifty-fourth St., No.* 353, four-st'y brick factory, tin roof; cost, $9,000; owners, J. & W. Williams, 361 West Fifty-second St.; architect, Geo. W. Hughes.

East Fifty-fourth St., No. 544, four-st'y brick tenement, tin roof; cost, $9,000, owner and builder, Geo. T. Leaird, 6 West Fifty-first St.; architect, M. V. B. Ferdon.

Marion Ave., w s, 200′ s John St., two-st'y frame dwell., shingle roof; cost, $3,000; owner, Michael Hart, 2569 Marion Ave.; architect, F. D. Miller.

Sixty-second St., s s, 182′ e Madison Ave., two-st'y brick stable, gravel roof; cost, $10,750; owner, Phineas C. Kingsland, 24 East Sixty-first St.; architects and builders; Chas. Buck & Co.

One Hundred and Fourteenth St., s s, 270′ e First Ave., 2 four-st'y brick tenements, tin roofs; cost, each, $12,000; owner, Peter McCormick, 416 East One Hundred and Fifteenth St.; architect, J. H. Valentine.

Sixteenth St., s s, 282′ 8″ e Eighth Ave., 2 five-st'y brick tenements, tin roofs; cost, each, $17,000; owner, Annie Fettretch, 960 Park Ave.; architects, Cleverdon & Putzel.

One Hundred and Sixty-sixth St., s s, 150′ e Franklin Ave., two-st'y frame dwell., tin roof; cost, $3,500; owner, Thos. S. Morris, 1106 Franklin Ave.; builder, Simon Wright.

One Hundred and Third St., n s, 260′ e Third Ave., 4 five-st'y brick tenements, tin roofs; cost, each, $13,000; owner, Caroline Yost, 316 East One Hundred and Twenty-fifth St.; architect, A. Spence; builder, A. Yost.

Henry St., No. 93, five-st'y brick tenement and store, tin roof; cost, $15,000; owner and carpenter, P. A. Fogarty, 409 West Fourteenth St.; architect, John P. Leo; mason, Thos. Cockerell.

Avenue A, e s, from Fifty-fourth to Fifty-fifth St., 8 five-st'y brick tenements and stores, tin roofs; cost, each, $12,000; owner, Geo. W. Totten; architects, A. B. Ogden & Son.

Delancey St., Nos. 292 *and* 294, 2 five-st'y brown-stone front tenements, tin roofs; cost, each, $18,000; owner, Manhattan Construction Co., 120 Broadway; architect, Alfred Kehoe.

Bailey Ave., e s, 75′ s Old Boston Road, two-st'y frame dwell., shingle roof; cost, $3,200; owner, Jas. M. Miller, Kingsbridge; architect and builder, Samuel L. Berrian.

Concord Ave., e s, 22′ s Clifton St., two-st'y frame dwell. and store, tin roof; cost, $3,500; owner, Henry Eberhardt, cor. Concord Ave. and Clifton St.; architect, Adolph Pfeiffer.

Wooster St., Nos. 39 and 41, three-st'y brick store, with one-st'y extension, tin roof; cost, $——; owner, Wm. Collins, 59 East Ninety-first St.; architect, Jos. M. Dunn.

East Twelfth St., No. 518, rear, four-st'y brick workshop, tin roof; cost, $3,000; owner, John H. Menkens, on premises; architects, Berger & Baylies; builders, Miller & Doerfler.

ALTERATIONS. — *Second Ave., No. 34, and No. 43 Second St.*, raise one st'y; cost, $4,500; owner, Levy Rothschild, 429 East Eighty-fifth St.; architect, A. H. Blankenstein.

St. Marks Pl., No. 67, raise attic to full st'y, new flat roof; also, a four-st'y brick extension, tin roof; cost, $8,000; owner, Moses Zimmerman, 318 East Houston St.; builder, Julius Boekell.

One Hundred and Thirty-fourth St., s s, 150′ s Lincoln Ave., one-st'y brick extension, gravel roof; cost, $3,500; owner, N.Y. Wood Turning Co., on premises; architect and builder, Wm. J. Merritt.

Broadway, w s, 21′ s Fifty-third St., five-st'y brick extension, tin roof; cost, $8,000; owners, George H. Schastey & Co., 9 East Nineteenth St.; superintendent, Aug. Schastey.

Philadelphia.

BUILDING PERMITS. — *Lehigh Ave.*, e of Fairhill St., 2 two-st'y dwells., 17′ x 52′; R. B. Gorman, contractor.

Orthodox St., cor. Race St., two-st'y store and dwell., 16′ 6″ x 57′; W. Cunningham & Son.

Thirtieth St., n of Chestnut St., two-st'y stable, 30′ x 80′; A. T. Richards, contractor.

Tulip St., cor. Wissanoming St., two-st'y dwell., 37′ x 46′; J. S. Taylor, contractor.

Main St., n of Jefferson St., 2 three-st'y dwells., 18′ x 40′; J. D. Caldwell, contractor.

Palmer St., e of Frankford Ave., two-st'y dwell., 20′ x 58′; A. T. Richards, contractor.

Hope St., No. 1710, three-st'y dwell., 18′ x 30′; Englebert & Schmidt, contractors.

Reed St., No. 1327, three-st'y dwell., 16′ x 48′; Jno. Gibson, contractor.

Reed St., e of Twenty-first St., 2 two-st'y dwells., 16′ x 40′; M. Kennedy, owner.

Paul St., w of Meadow St., 2 two st'y dwells., 15′ x 44′; B. H. Foulkrod, contractor.

PROPOSALS.

CURBING.

[At Providence, R. I.]

BOARD OF PUBLIC WORKS,
OFFICE, CITY HALL,
PROVIDENCE, R. I., September 23, 1884.

Sealed proposals will be received at this office **until 11 o'clock,** A. M., **Thursday, October 9, 1884,** for furnishing, delivered in this city, 20,000 lineal feet of straight curbing.

The delivery to commence on or before November 1, 1884, to continue in regular monthly quantities, and be completed on or before October 1, 1885.

A bond, satisfactory to the Board in the sum of one-tenth of the estimated amount of the proposal, as liquidated damages for failure to execute the contract within ten days, if awarded, will be required of each bidder, and a satisfactory bond in the sum of one-quarter of the estimated amount of the contracts, conditioned upon the faithful fulfillment of the contracts will be required of the successful bidder.

Specifications and forms of proposals may be obtained upon application at this office.

The Board reserves the right to reject any or all proposals. CHAS. E. CARPENTER, } Board of
458 CLINTON D. SELLEW, } Public Works.

COTTAGES FOR KEEPERS OF LIFE-SAVING STATIONS. [At Washington, D. C.]

OFFICE OF GENERAL SUPERINTENDENT,
U. S. LIFE-SAVING SERVICE,
TREASURY DEPARTMENT,
WASHINGTON, D. C., September 6, 1884.

Sealed proposals will be received at this office **until 2 o'clock,** P. M., **of Thursday, the 9th of October, 1884,** for the construction of three frame cottages for keepers at the following-named life-saving stations on the Pacific coast: one at the Shoal-water Bay life-saving station, near light-house; one at the Cape Disappointment station, Baker's Bay (both in Washington Territory); and one at the Golden Gate Park station, San Francisco, Cal. The proposals may be for one or more of the cottages.

Bidders will state the time within which they will agree to have the buildings completed.

Each bid must be accompanied by a bond in the sum of $500, with two good and sufficient sureties, conditioned that the bidder shall enter into contract without delay and give such bonds as security for the faithful performance thereof as may be required if his bid be accepted, or by a deposit of $500 United States currency or bonds, to be returned to the unsuccessful bidders after the award of the contract, and to the successful bidder after his contract and bond for the faithful performance of the terms thereof shall be approved by the Secretary of the Treasury.

Specifications and plans, forms of proposal, contract and bond can be obtained at the offices of the Collector of Customs at Astoria, Or.; Capt. J. W. White, Assistant Inspector of Life-Saving Stations, East Oakland, Cal.; and of T. J. Blakeney, Superintendent Twelfth Life-Saving District, Room 25, Appraisers' Building, San Francisco, Cal.

All proposals must be indorsed "Proposals for the Construction of Keepers' Cottages," and addressed to the General Superintendent of the United States Life-Saving Service, Washington, D. C.

The right to reject any or all bids, or to waive defects, if deemed for the interest of the Government, is reserved. W. D. O'CONNOR,
Acting General Superintendent.

PROPOSALS.

PIERS.

[At New York, N. Y.]

Proposals for repairing Piers 43 and 44, and the piers at East Thirty-first and Thirty-second Sts., East River, will be received by the Dock Department, 117 and 119 Duane St., New York, **until Wednesday, October 8, 1884, at 12 o'clock,** M.

For full information see *City Record*. Copies for sale at No. 2 City-Hall.

IMPROVING APPOMATTOX RIVER, VA.

[At Norfolk, Va.]

U. S. ENGINEER OFFICE,
NORFOLK, VA., September 23, 1884.

Sealed proposals, in triplicate, will be received at this office **until noon of October 23, 1884,** and opened immediately thereafter, in the presence of bidders, for dredging one hundred and thirty-five thousand (135,000) cubic yards more or less, and for furnishing small quantities of piles, lumber, gravel, brush, binding poles, bolts, and spikes for the improvement of Appomattox River, Virginia.

Specifications, instructions to bidders, and blanks for proposals can be had on application to this office.

460 F. A. HINMAN, Capt. of Engineers, U.S.A.

CONCESSIONS AND PRIVILEGES,

[At New Orleans, La.]

The management of the World's Industrial and Cotton Centennial Exposition at New Orleans invite sealed proposals for concessions and privileges, to be indorsed "Proposals for Privileges," and addressed to E. A. Burke, Director General, New Orleans. Circulars containing detailed information can be obtained from the offices of the World's Industrial and Cotton Centennial Exposition as follows: Chauncey Dunnmore, cor. of Broadway and Chambers Sts., New York, N. Y.; B. S. Pardee, 31 Milk St., Boston, Mass.; S. E. Nutt, Continental Hotel, Philadelphia, Pa.; J. W. Ryckman, Palmer House, Chicago, Ill.; F. F. Hilder, 620 Chestnut St., St. Louis, Mo.; T. M. Barda, care of the Southern Exposition, Louisville, Ky.; A. J. McWhirter, Nashville, Tenn.; Colonel A. Andrews, San Francisco, Cal.; Thomas Christian, Richmond, Va.; Homer Hamilton, Cleveland, O.; E. L. Roche, Charleston, S. C.; T. F. Plunkitt, Hartford, Conn.; F. M. Williams, 33 Sycamore St., Cincinnati, O.

GLOBE LANTERNS AND EXTRA GLOBES.

[At New York, N. Y.]

DEPOT QUARTERMASTER'S OFFICE,
NEW YORK CITY, N. Y., September 16, 1884.

Sealed proposals, in triplicate, subject to usual conditions will be received at this office **until 12 o'clock, noon, October 16, 1884,** at which time and place they will be opened in presence of bidders for furnishing and delivering at this depot, free of charge for cartage and packages, 400 globe lanterns and 800 extra globes for the same. The lanterns must be arranged to burn both oil and candle, and be of a pattern and size to use the same style and size of globes, wicks and candles as the standard sample, which can be seen at this depot. Samples must accompany proposals. The Government reserves the right to reject any or all bids, or to accept as may be most advantageous to the Department. Preference will be given to articles of domestic production and manufacture, conditions of price and quality being equal, and such preference given to articles of American production and manufacture produced on the Pacific coast to the extent of the consumption required by the public service there.

Blanks and information as to bidding, etc., will be furnished by this office on application.

Envelopes containing proposals should be marked "Proposals for Lanterns," etc., and addressed to the undersigned. HENRY C. HODGES,
458 Lieut.-Col. Deputy Quartermaster General.

INDUSTRIAL SCHOOL BUILDING.

[At Devil's Lake Agency, Dak.]

DEPARTMENT OF THE INTERIOR,
OFFICE OF INDIAN AFFAIRS,
WASHINGTON, D. C.

Sealed proposals, indorsed "Proposals for the construction of an Industrial School Building at Devil's Lake Agency, Dak.," will be received at the office of the agent of the Devil's Lake Agency, Fort Totten, Dak., **until October 14, at 12 o'clock,** M.

The building is to be frame, 35′ x 100′, two stories. Complete plans and specifications of the work can be examined at the office of the *Inter-Ocean*, of Chicago, Ill., the *Pioneer Press*, of St. Paul, Minn., and at the agency.

The contract to be awarded to the lowest responsible bidder or bidders, subject to the approval of the Secretary of the Interior. The right is, however, reserved to reject any and all bids, or any part of any bid, if deemed for the best interests of the service.

Time required to complete the building will be taken into consideration, and proposals must state the length of time required for the completion of the building after the approval of the contract.

Each bid must give the name of all the parties interested in or parties to it, and a copy of this advertisement must be attached to bid, with post-office address.

Each bid must be accompanied by a certified check or draft upon some United States depository, payable to the order of John W. Cramsie, U. S. Indian agent, which check or draft shall be not less than five per centum on the amount of the bid, and shall be forfeited to the United States in case any bidder receiving an award shall fail to execute promptly a contract with good and sufficient sureties, according to the terms of his bid; otherwise to be returned to the bidder.

Bids not accompanied by a certified check or draft will not be considered.

Parties receiving awards will at once enter into contract.

The contract will provide for three payments, two of which will be made at such stages of the work as will fully protect the United States; the last payment to be made when the building is completed and accepted.

COMMISSIONER.

PROPOSALS.

WING-DAMS, ETC.

[At Augusta, Ga.]

UNITED STATES ENGINEER OFFICE,
ARMY BUILDING, NEW YORK, September 18, 1884.

Sealed proposals, in triplicate, to be opened **at 12 o'clock, noon, on the 17th day of October, 1884,** are invited for the construction of wing-dams in the Savannah River, below Augusta, Ga., and in the Altamaha River, Georgia. The proposals for each of the works must be separate, and the indorsement on the envelope must name the work for which the proposal is offered. A bidder may propose for one or both of the works at his option. Specifications, instructions to bidders, and blank forms of proposals may be obtained at this office. Q. A. GILLMORE,
459 Col. of Engineers, Brevet Maj.-Gen., U.S.A.

STEAM-PIPE AND FITTINGS.

[At Boston, Mass.]

NAVY PAY OFFICE, 45 MILK ST.,
BOSTON, September 29, 1884.

Proposals, in duplicate, sealed and endorsed "Proposals for Steam-Pipe and fittings," will be received at this office **until October 6, 1884, at 12 o'clock,** M., to be opened immediately thereafter in presence of bidders, for furnishing at the Navy Yard, Boston, and subject thereto the usual Government inspection, the articles called for on requisition No. 16, consisting of steam-pipe and fittings. The price bid to include delivery at the Boston Navy Yard.

Specifications and blanks for bids furnished by this office. Two satisfactory sureties must accompany the bid, guaranteeing a faithful execution of the offer if accepted. The right is reserved to reject any and all bids not considered advantageous to the Government.

460 C. W. ABBOT, Pay Director, U. S. Navy.

COURT-HOUSE.

[At Cincinnati, O.]

OFFICE BOARD TRUSTEES TO REBUILD COURT-HOUSE, HAMILTON COUNTY, O.
COURT-HOUSE YARD, CINCINNATI, O., Oct. 1, 1884.

Sealed proposals will be received at this office **until 9 o'clock,** A.M., **on Saturday, the 18th day of October, 1884,** for furnishing and setting in place all the wrought and cast iron work required for the rebuilding of the Hamilton County, Ohio, Court-House, according to plans and specifications on file in this office, and also at the office of James W. McLaughlin, architect, 46 and 47 Johnston Building, Cincinnati.

All bids to be made upon printed forms furnished on application to this office, and subject to all the conditions therein provided. No others will be considered.

The Board reserve the right to reject any and all bids. By order of the Board.

458 J. CLIFFORD GOULD, Clerk.

STONE AND BRICK WORK.

[At Council Bluffs, Iowa.]

OFFICE OF SUPERVISING ARCHITECT,
TREASURY DEPARTMENT,
WASHINGTON, D. C., September 27, 1884.

Sealed proposals will be received at this office **until 2** P. M., **on the 18th day of October, 1884,** for all the labor and material, stone, brick, mortar, etc., and building complete the basement and area walls of the post-office, etc., building at Council Bluffs, Iowa, in accordance with drawings and specification, copies of which may be seen and any additional information obtained on application at this office or the office of the superintendent.

Bids must be accompanied by a certified check, and those received after the time of opening, will not be considered. H. G. JACOBS,
459 Acting Supervising Architect.

DAM.

[Near Frankfort, Ky.]

U. S. ENGINEER OFFICE, 82 WEST THIRD ST.,
CINCINNATI, O., September 1, 1884.

Sealed proposals, in triplicate, will be received at this office **until noon, local time, on Monday, October 20, 1884,** for furnishing all materials and labor for constructing Dam No. 5, Kentucky River, about seventeen miles above Frankfort, Ky.

Approximate estimate of materials: —

126,764 lineal feet of timber,
96,000 pounds of iron, drift-bolts and spikes,
8,359 pounds of iron anchoring-bolts,
19,000 cubic yards of rip-rap stone,
352,588 feet B. M. of sheeting,
6,000 cubic yards of gravel backing.

Specifications, printed forms of proposals, and information will be furnished on application to D. L. Sublett, at Frankfort, Ky., or to the undersigned.

459 JAMES C. POST, Captain of Engineers.

LUMBER.

[At Santee Agency, Neb.]

SANTEE AGENCY, NEB., September 2, 1884.

Sealed proposals endorsed "Proposals for lumber," will be received at the office of the United States Indian Agent, Santee Agency, Neb., **until 1 o'clock,** P. M., **of Thursday, October 9, 1884,** for furnishing the Santee Agency with, the Ponca Agency with, and the Flandreau Agency with a variety of lumber, windows, doors, etc., for forty (40) houses (thirty for Santee and ten for Flandreau) to be delivered at Santee and Flaudreau Agencies, Nebraska and Dakota, a list of which can be obtained upon application at this office.

All articles delivered under contract will be subject to a rigid inspection by some proper party to be designated by the department.

All bids must be accompanied by certified checks on some United States depository or cash for at least five (5) per cent of the amount of the proposals; which check or cash will be forfeited to the United States in case any bidder or bidders fail to execute a contract with good and sufficient sureties, otherwise to be returned to the bidder.

The right is reserved to reject any or all bids, or any part of any bid if deemed for the best interest of the service. ISAIAH LIGHTNER,
458 United States Indian Agent.

Publishers' Department.

The American Architect and Building News.

PUBLISHED EVERY SATURDAY BY

JAMES R. OSGOOD & COMPANY,

211 TREMONT STREET, BOSTON, MASS.

BRANCH OFFICE, 658 BROADWAY, NEW YORK.

15 cents per copy; $6.00 per year; six months, $3.50; 12 Monthly Numbers, $1.75.

☞ Payment should be made *directly* to the publishers, either by draft or post-office order.

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STANDARD CEMENT CO. (Hartford, Conn.), Cement. Page xviii.
J. PASQUALI & C. AESCHLIMANN (New York), Marble Mosaics. Page xiii.

WANTED.

SITUATION. — Permanent situation by a competent architect's assistant of ten years' experience. Versed in design, perspective, and details; excellent references. Address R., 2131 Pine St., Philadelphia, Pa. 458

WANTED.

SITUATION. — Wanted, situation, by a competent draughtsman of over fifteen years' experience. Construction and perspective have received special attention. Address, "E.," care *American Architect*. 459

FOR SALE.

THE pews (150), heaters (six), and globe-lights in ceiling (eight) in Hudson Ave. M. E. Church, Albany, N. Y., all in excellent condition, and will be sold cheap. Apply to S. L. Munson, Albany, N. Y.

FOR SALE.

SEVEN years of *American Architect*, bound. For particulars, address, Hodgson, Wallingford & Stern, architects, Indianapolis, Ind.

NOTICE!

THERE will be a meeting of the executive committee of the National Association of Master Plumbers of the United States held in St. Louis, October 15, 1884. As this meeting will be a very important one, it is necessary that all members of the committee should be present. A. YOUNG, *President*.
J. J. WADE, *Secretary*.

PROPOSALS.

COURT-HOUSE AND JAIL.
[At St. Clairsville, O.]

AUDITOR'S OFFICE, BELMONT COUNTY,
ST. CLAIRSVILLE, O., September 4, 1884.

Sealed proposals will be received at the auditor's office, Belmont County, Ohio, from the 4th day of September, to the 6th day of October, 1884, inclusive, **until 1 o'clock**, P. M., of the day last mentioned, for furnishing materials and performing the necessary labor for the erection of a court-house and jail, at St. Clairsville, O.

Each class of work and materials to be separately bid upon, to which may be added a bid for the entire work including materials.

Plans, specifications and bills of material may be seen at the auditor's office, in said county on and after the 4th day of September, 1884, and at the office of J. W. Yost, Architect, 67 South High St., Columbus, O. Each bid must be accompanied with bond equal to 25 per cent of the amount of the bid as a guaranty that if awarded, the contract will be completed, and proper bond given for its completion.

The right to reject any or all bids is reserved.

Blanks will be furnished bidders on request.

458 R. R. BARRETT, Auditor.

ORDNANCE SUPPLIES.
[At Rock Island, Ill.]

ROCK ISLAND ARSENAL,
ROCK ISLAND, ILL., September 12, 1884.

Sealed proposals in triplicate, upon the blank forms furnished from this arsenal only, will be received by the undersigned **until 12 o'clock, M., on Thursday, October 16, 1884,** at which time they will be publicly opened, for furnishing the following classes of supplies, in such quantities and at such times during the fiscal year ending June 30, 1885, as the commanding officer of this arsenal may require, viz.: blankets, forage, bar iron, steel, brass, iron and copper rivets and burs, wire, nails, leather, thread, cotton duck, stationery, paints, oils, etc. All articles will be subjected to a rigid inspection; full compliance with the specifications will be insisted upon, and no articles of inferior quality will be accepted. The Government reserves the right to reject any or all proposals or parts thereof. A preference will be given to articles of domestic production and manufacture, conditions of price and quality being equal. Forms containing instructions to bidders, a copy of this advertisement, blank form of proposals, and specifications for supplies, with column for prices to be filled by the bidder, can be had upon application by mail or in person to the undersigned, and samples of the supplies can be seen at this arsenal.

Envelopes containing proposals should be marked "Proposals for Ordnance Supplies," and addressed to the undersigned.

Bidders are invited to be present at the opening.

D. W. FLAGLER,
458 Lt.-Colonel of Ordnance, Commanding.

PROPOSALS.

SEWERS.
[At Moberly, Mo.]

CITY-HALL, MOBERLY, MO., September 16, 1884.

Sealed proposals for excavating and constructing sewers will be received at the City Council Room in Moberly, **at 7.30 P. M., October 10, 1884.**

The plans and specifications, with all particulars, can be seen at the office of E. Cook, City Engineer, on and after the 26th day of September, 1884.

Each bid to be accompanied by two disinterested sureties, the city officials reserving the right to reject any or all bids. D. S. FORNEY, *City Mayor*.
V. TEDFORD, *City Clerk*.

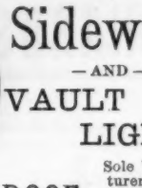
JOINER'S WORK AND WOOD FLOORING.
[At Kansas City, Mo.]

OFFICE OF SUPERVISING ARCHITECT,
TREASURY DEPARTMENT,
WASHINGTON, D. C., September 17, 1884.

Sealed proposals will be received at this office **until 2 P.M., on the 15th day of October, 1884,** for furnishing and fixing in place complete, all the joiner's work and wood flooring required for the custom-house and post-office building at Kansas City, Mo., in accordance with drawings and specification, copies of which and any additional information may be had on application at this office, or the office of the superintendent.

Bids must be accompanied by a certified check, and those received after the time of opening will not be considered. M. E. BELL,
458 Supervising Architect.

Continued on page xii.



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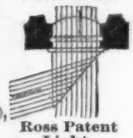

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The finest and most extensive structures in this country are painted with these paints, among them, the U. S. Capitol at Washington; Light Houses and Life Saving Stations; U. S. Custom House at Chicago; Navy Yard Buildings; Metropolitan Elevated R. R; Oriental and Manhattan Beach Hotels; Oriental and Manhattan Beach Hotels; the "Argyle" and Cottages at Babylon; Hygeia Hotel, Fortress Monroe; Thousand Islands House; Crossman House; Forest Hill House, Franconia, N. H.; Sinclair House, Bethlehem, N. H.; Fort Point House, Stockton, Me.; Pequot House and Cottages, New London, Conn.; Appledore House, Isle of Shoals; the "Dakota," New York City, and thousands of other public and private buildings. Our pamphlet on

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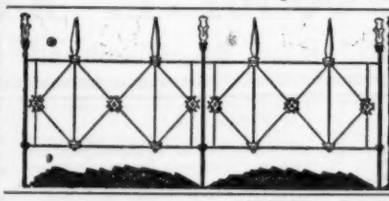

ONE OF OUR RAILINGS are worth two of any other kind, but we will sell this pattern of **Composite Wrought Iron Railing,** at the rate of $1.50 per lineal foot 3 ft. high. The Chilled Iron Ornaments are poured on to the Wrought Iron Rods welding the panel into one piece without joints or crevices for rust to enter. It is made to set on stone or to go into ground.
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Visitors' Correspondence may be addressed in care of this establishment.

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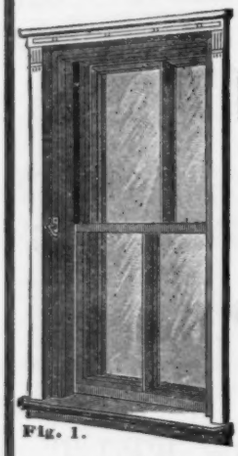

Fig. 1.

Fig. 1.—Interior view of window, with ATTWELL LOCK applied, the key-head and escutcheon being alone visible.

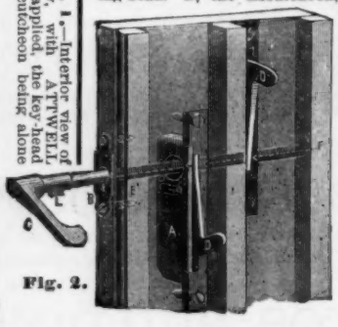

Fig. 2.

Fig. 2.—Sectional view of frame at left of meeting-rails of sash, showing Locks A A mortised into frame on right and left of parting-bead. B, the Escutcheon, located over keyhole in reveal of frame. C, the REMOVABLE Key, controlling from the ONE POINT THE TWO LOCKS A A. D D, the Bolts of Locks, one controlling each sash, operated separately, but working in combination. L, a lug on key, used in operating "shut off"—*i. e.*, holding, at pleasure, either bolt out of engagement with "strike."

Fig. 3.

Fig. 3.—Section of sash showing location and application of "strike." This "strike" gives four locking or ventilating points to each sash within a radius of safety from the admission of the thief's body.

☞ The Keys, Bolts and Strikes are all made of best Malleable Iron.

As may be seen, these Locks are so located and constructed that *the thief cannot control or force them*, and are especially *convenient to the user*. You can *ventilate*, and, by *removing key*, lock with *safety* at same time. The sashes are *automatically locked*, dispensing with all *care and labor* of closing, and avoiding the possibility of an *omission to lock*. An **ideal sash lock** *to every window, and, where weights are not used*, lends all needed power for *holding and controlling either sash, or both, for purposes of ventilation!* They are *simple in construction, easily applied, adapted to all windows, thoroughly practical in mechanical detail, and are truly possessed of every attribute and novel power claimed for them.*

The Locks are finished in Tucker, Nickel and Bronze; *retail at* 25, 37½ *and* 50 *cents per window;* come neatly packed (hardware complete for one window, with screws, in single box), and *advertising matter*, together with a *perfect working model* (same as Fig. 1), *is supplied gratuitously to the dealer*. Sample Locks, nickel finish, in section (same as Fig. 2), showing application and operation, shipped to any address on receipt of 50 cents. Circulars, Price List and Discounts forwarded on application. Respectfully, &c.,

THE ATTWELL MFG. CO.,

Principal Office: 357 Race St., Cincinnati, Ohio, U. S. A.

PROPOSALS.

LEVEE REPAIR WORK.
[At Memphis, Tenn.]
U. S. Engineer Office,
Memphis, Tenn., September 25, 1884.

Sealed proposals in duplicate will be received till **12 o'clock, noon, October 6, 1884,** at this office, for repairs of levees in Mississippi, damaged by wave wash, as follows, viz.:—

Section 1—Riverton to Hughes, about 33,000 cubic yards.

Section 2—Clay & Bagott to Easton's, about 32,000 cubic yards.

Bids for either or both sections will be received. Contractor getting both sections will be required to carry them on simultaneously.

Bidders are requested to be present at opening of bids.

Blank forms for proposals, instructions to bidders, and specifications concerning the work may be obtained by addressing this office. Proposals must be made on forms furnished.

The United States reserves the right to reject any or all proposals.

Proposals must be addressed to the undersigned, and marked on envelope "Proposals for Levee Repair Work.
CLINTON B. SEARS,
458 Capt. Engineers, U. S. A.

SUPPLIES AND MATERIAL.
[At Memphis, Tenn.]
U. S. Engineer Office,
Memphis, Tenn., September 25, 1884.

Sealed proposals, in duplicate, will be received **till 12 o'clock, noon, of October 25, 1884,** at this office, for furnishing any or all material required for the Second and Third Districts, Mississippi River, for the fiscal year ending June 30, 1885, consisting of rope, iron, wire, nails, spikes, hardware, castings, oils, paints, lumber.

The probable quantities required will be found in the form furnished. Preference will be given to articles of domestic production.

Bidders are requested to be present at opening of bids. Blank forms for proposals, instructions to bidders and specifications may be obtained by addressing this office. Proposals must be made on forms furnished. The United States reserves the right to reject any or all proposals.

Proposals must be addressed to the undersigned and marked on envelope "Proposals for Supplies and Material, Second and Third Districts, Mississippi River."
460 CLINTON B. SEARS.
Capt. Engineers, U. S. A.

PUMPING-ENGINE.
[At Bowling Green, Ky.]

Sealed proposals, addressed to the undersigned, will be received by the Water Commissioners of Bowling Green, Ky., **until October 15, 1884, at noon,** for furnishing, building, and erecting, complete, one compound condensing steam pumping-engine, of two and one-half million United States gallons' capacity per twenty-four hours, and also for a non-compound condensing engine of like capacity.

Specifications and further information can be obtained from the undersigned, or from Chas. Hermany, the Consulting Engineer, by addressing him at Louisville, Ky.
JAS. H. WILKERSON,
458 Supt. Water Works, Bowling Green, Ky.

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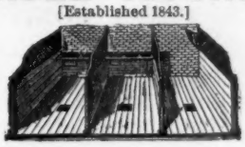

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Interior decorations made from Architects' Specifications.

J. PASQUALI & C. AESCHLIMANN,
Manufacturers of Roman and Venetian
Marble Mosaics,
For Floors, Walls, Ceilings, Mantels, Hearths, Decorations, etc. 231 East 28th St., Bet. 2d & 3d Aves. N. Y. Prices very moderate. *References:* Principal Architects and decorators of N. Y. *Note.*—A party advertising to have superintended all work of this nature in N. Y. has never superintended any work there.

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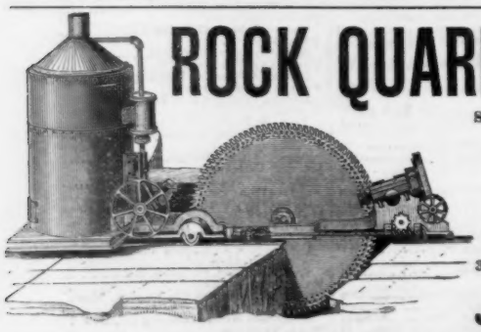

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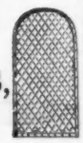

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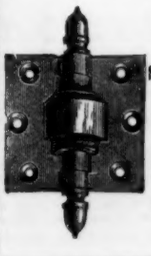

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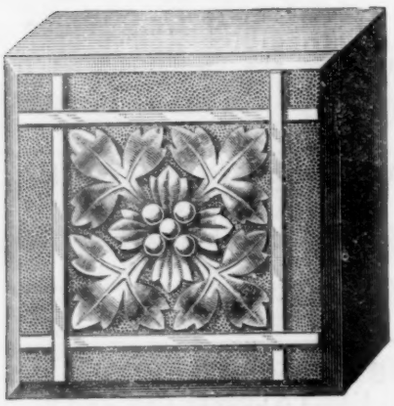

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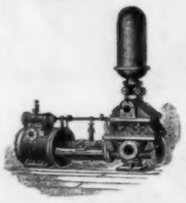

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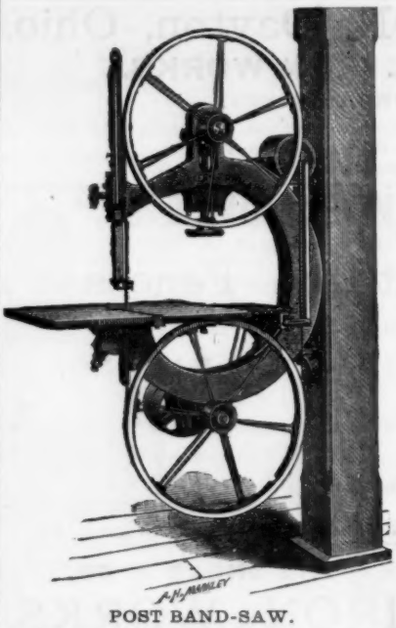

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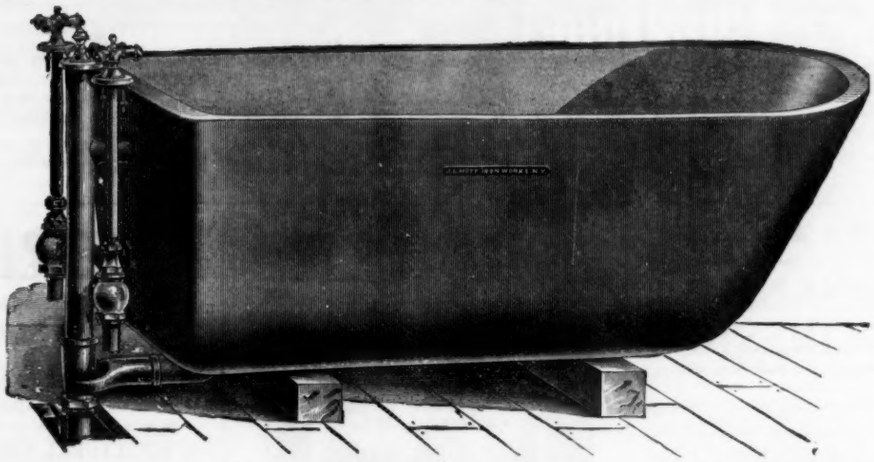

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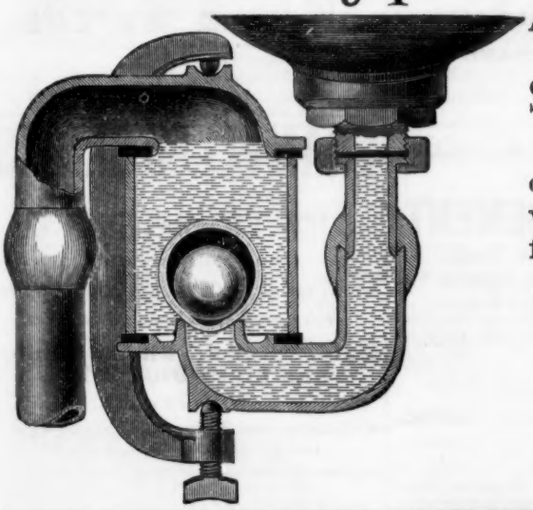

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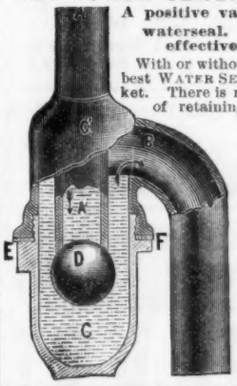

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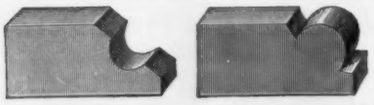

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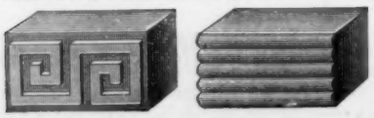

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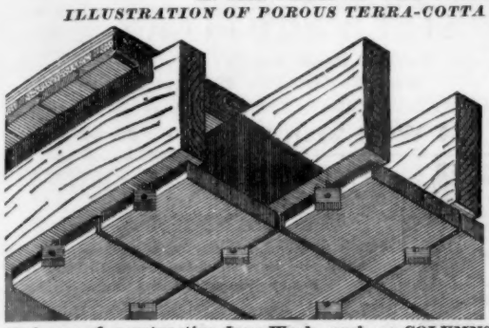

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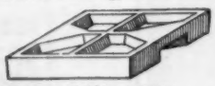

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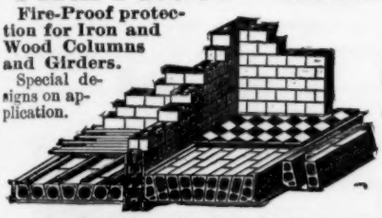

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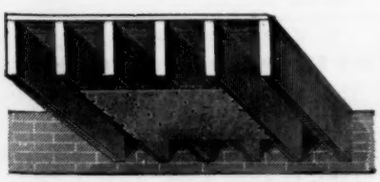

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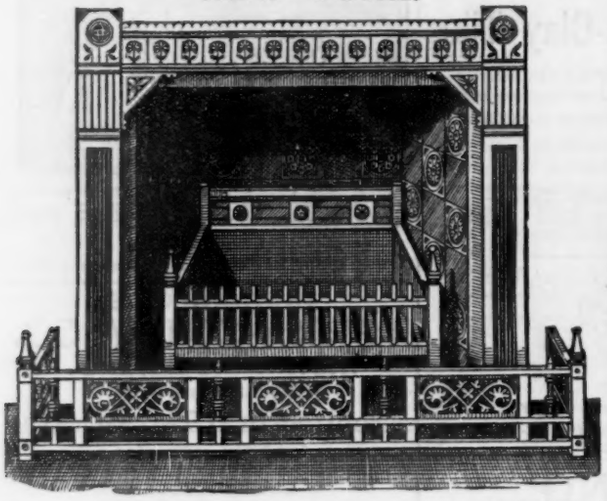

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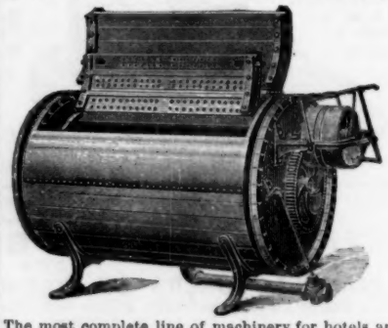

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